The 2006 BPM Suites Report

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Derek Miers
Paul Harmon
Curt Hall
Claims

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Foreword

This is one of a series of three reports that BPTrends publishes on business process software products. (The other two reports are the BPTrends Enterprise Architecture, Process Modeling and Simulation Tools Report and the BPTrends Business Rule Report.) We published the first BPM Suites Report, V 1.0, in March, 2005, and we had such an overwhelmingly positive response that we published Version 1.1 in November and committed to updating the report on an annual basis in order to provide our members and readers with current reviews of the leading BPM Suites. In this report we define the market, describe the features important in a BPM Suite, provide detailed reviews of the leading players and their products, and provide a comparison of the key features of the products.

Figure 1 provides an overview of the business process software products market as BPTrends currently defines it. We use circles to represent the major product groupings and have overlapped circles to suggest key relationships. The olive area in the center of Figure 1 represents the vendors that we focused on in this report.

![Figure 1 – The BPM Suites Report focuses on the olive area](image)

**What Are BPM Suites?**

When you review the range of software products being used for business development, you realize that the product categories overlap. BPM Suites invariably include process modeling capabilities, and some Process Modeling tools generate BPEL code. The difference between tools that properly belong in the EA, Process Modeling and Simulation category and the products that are included in the BPM Suites Report ultimately comes down to how practitioners use the specific products.
Enterprise Architecture, Process Modeling, and Simulation tools are generally used by practitioners who are trying to understand how their organizations or their business processes work, usually as part of a project to create a new process or to redesign or improve an existing process. They are also used to document existing processes and to define goals and measures for evaluating those processes.

BPM Suites, on the other hand, are used to automate and control processes as they are executed, and BPM Suite developers do process modeling in preparation for this task. Tools used to manage the execution of business processes are included in the BPM Suites Report, and their process modeling capabilities are only considered in the context of this broader goal. In a similar way, most BPM Suites include the ability to capture business rules and use them to control processes as they are executed. Thus, we only include business rules products in this report if they are used to support a BPM Suite.

Our objective in this report is to present the various options available within the BPM market, not to choose or rank the “best” BPM suite. Thus, we identified a set of core criteria. This report includes tools that include the ability to:

- model a business process,
- link elements of the process model to human interfaces, software components, and databases that are used in the runtime execution of the process, and
- manage the actual execution of the process by calling human or software components, or by acquiring or storing data as prescribed by the process description. “calling” human or…?

All other features are treated as extensions of the core BPM capability that simply render the tool more useful for the development of specific types of applications. We focus on positioning each product in terms of its unique capabilities and primary strengths. We included products that some might regard as Rule-Based Management tools, EAI tools, or Workflow tools, if the vendors indicated that they are targeting the BPM market. Similarly, we have included BPM tools that are incorporated into operating or server environments.

The Current BPM Market

We are still in the early days of BPM automation. BPM advocates continue to project what companies will want to do in the future, but until companies gain more experience with BPM Suites, no one can confidently predict what the popular BPM products of the future will look like. Most BPM Suites today offer a variety of different capabilities and vendors and users continue experimenting to determine what combination of features will prove most valuable. Thus, it would be a mistake to provide a rigid definition of BPM Suites or to propose a way of evaluating which BPM Suites are the best. Vendors are working to add features to improve their products as they get feedback from users. Meanwhile, new vendors are continuing to enter the market, larger vendors are acquiring smaller vendors and some vendors are disappearing, unable to compete. Predictably, as the market continues to mature, more sophisticated features will appear, niche markets and vertical market applications will emerge and products will continue to evolve to meet changing market requirements. For a more detailed discussion of the BPM Suites market, see the section entitled An Introduction to BPM Suites

Given the complexity of the current market for BPM Suites, we have avoided any comparisons suggesting that some tools are the “winners” while others are “less desirable.” Instead, we analyze each product, explain what specific markets the vendor is pursuing, consider how the tool is adapted for that market, and identify what is special or unique about each product.

To make comparisons as easy as possible, we have explored the capabilities of BPM Suites across several dimensions. These are discussed in Section 2: A Detailed Analysis of BPM Suites. Some vendors only implement a subset of the features we describe. That does not necessarily detract from their offering. It could mean that the vendor does not think the feature is required for the target market. Or, it could mean that the vendor thinks it is more efficient to partner with another vendor who provides that specific feature. For example, we asked each vendor how they support business rule capture and
execution. Some have built their own rules engine into their Suite. Others provide an embedded rules engine which was developed by a third party. Still others don’t provide a rules engine, and allow users to select their own. No one of these solutions makes the underlying BPM Suite better or worse, although it may make it more or less popular with a particular user group. Users that already have a rules engine may prefer a BPM Suite without an embedded rules engine. Users at companies that do not currently have a standard rules engine may prefer a tool with an integral rules engine. As we said, it would be inappropriate to say exactly what the ideal BPM Suite should have or not have. We have sought to provide a simple, clean description of the current features available from each product in this report.

**Participating Vendors**

BPTrends contacted all the BPM vendors we could identify and solicited their participation in this Report, and each participating vendor was charged a small fee. All products from participating vendors were evaluated in the same manner: Derek Miers and Paul Harmon prepared a detailed questionnaire which we asked each vendor to complete. Subsequently Derek Miers, Paul Harmon and Curt Hall reviewed the questionnaires, studied the product documentation and all other relevant materials provided by the vendors, and requested a product demonstration. Finally, we spoke with each vendor to eliminate any confusion and to make certain we had not overlooked anything. We did not conduct any actual product testing. We will continue to maintain, update and expand this report going forward, and we welcome new vendors who would like to be included in future versions. Please contact me directly if you are interested.

**Thanks to Our Coauthors and Members**

I want, again, to thank our friend and colleague, Derek Miers, for the outstanding work he did as the principal analyst and author of the original BPM Suites Report. Derek’s knowledge of the BPM Suites market proved invaluable insight in the design, research and writing of the original Report. Thanks, too, to Market Analyst, Curt Hall, for his contribution to the new participating vendors in Version 2.0. I also wish to thank my longtime friend and business partner, Paul Harmon, for bringing his vision, knowledge, and perspectives on the business process performance market to bear on this report. Thanks also to our Managing Editor, Carolyn Potts, and our Copy Editor, Jim Eilers, for their contribution to the editing and production of this report. We couldn’t have done it without them. Finally, I want to thank all our BPTrends members and readers who continue to support us. We hope this updated report will be informative and useful to you as you continue to pursue work on your BPM initiatives.

**Celia Wolf**

CEO and Publisher

**Business Process Trends**

cwolf@bptrends.com
An Introduction to BPM Suites

1 Why the Sudden Interest in BPM?

Business managers have talked about processes and process change for decades. Why, you might ask, have so many managers recently begun to talk about Business Process Management (BPM) and BPM Suites? Broadly, the answer involves two changes that have taken place in the past few years. The first is the widespread adoption of the Internet and the development of XML – the web protocol that makes it much easier to package data and link applications together. In essence, the Internet and XML have led to a quantum leap forward in our ability to integrate enterprise applications.

At the same time, workflow systems, first popularized in the mid-90s, have matured and are now widely used. In essence, when we refer to workflow systems in this context, we refer to systems that manage the interaction between employees and data. Early workflow systems were designed to manage document processing. Forms were scanned and stored in databases. Then the electronic versions of the forms were routed to employee terminals so that they could be processed. As soon as one employee finished with a form, it was automatically routed to the next employee who had to see it. By the late 90s, workflow systems had been integrated into Enterprise Resource Planning (ERP) applications to facilitate the interaction of employees with ERP applications. It was soon discovered, however, that the management of multiple workflow engines – one for each ERP application – was too complex. It became clear that it would be better to have a single workflow engine that could manage all the employees and all the applications used in a complete business process. This insight – combined with the drive on the part of Enterprise Application Integration (EAI) vendors to add workflow elements to their products and a similar drive on the part of workflow vendors to add EAI elements – led to BPM.

In essence, a variety of different people realized, more or less simultaneously, that it would be useful to create a single system that could handle multiple workflow applications while simultaneously handling the integration of the various software applications. The foundation for the creation of BPM systems that could manage the required complexity at a reasonable cost was made possible by the adoption of the Internet and XML. The impetus to proceed has been driven by companies that want to combine a wide number of different applications and subprocesses into single business processes that can be managed by a single system. Vendors have spent the past 3-4 years trying to determine how best to combine Internet technology, EAI techniques, workflow techniques, and a variety of interface and monitoring technologies into a single package that will make it easier for business managers to control, maintain, and change their business processes.

2 A BPM Overview

No matter what technology is incorporated in BPM products, companies will not acquire BPM Suites simply to obtain new technology. Businesses are interested in BPM products because they hope that BPM will lead to enhanced business performance, greater agility, and reduced risks. BPM Suites deliver enhancing business performance by offering business managers a way to effectively coordinate all the necessary human and technological resources required to perform a business process. At the same time, the development of a BPM system provides the business with an opportunity to review existing processes, automate additional activities, and remove redundancies. Once a BPM system is in place, it simplifies future changes and the routine maintenance of the process. In essence, an explicit model of the business process drives the BPM system. Once created, routine changes in the process can be made simply by changing the business process model.

Companies are just beginning to explore the use of BPM systems. There is, as yet, no agreement about what should be included in a BPM Suite or in a BPM system. Nearly everyone agrees that you begin by defining a business process, and, subsequently, use a BPM Suite to manage the runtime execution of the
An Introduction to BPM Suites

process. Depending on which vendor or evangelist you listen to, you may also want to include simulation, business rules, optimization, XML services, monitoring, business intelligence, or industry-specific templates or frameworks in your BPM effort. It will be awhile before there is widespread agreement on exactly what should be included in a comprehensive BPM solution.

BPM vendors and users are working in a number of venues to define BPM standards. As the various standards become available and prove their value, BPM definitions will change to accommodate them.

In spite of a certain amount of hype and spin, which is inevitable in any new market, most companies that have studied BPM have concluded that BPM offers them an opportunity to improve the efficiency of their process management practices, while simultaneously aligning human and IT resources more effectively. In part, this is a result of the technological advances we mentioned earlier, and, in part, it results from a new willingness to think about processes in a more comprehensive way. As companies have become more international and have opted to rely on more extensive outsourcing, the boundaries around the modern company have become more permeable. We need new, more comprehensive ways of understanding exactly what is involved in a business process. Most companies, as we have already suggested, are just beginning to explore the uses of BPM. These companies typically limit the scope of their initiatives to a single function or department. Companies with more experience, however, are exploring more comprehensive uses of BPM. More experienced companies, however, are exploring the possibility of creating BPM systems that encompass entire value chains so that managers can track and control business processes that range from the supplier's supplier all the way through to the customer's customer.

Historically, business process change initiatives have often resulted in significant process improvements. Few efforts, however, have been documented in a way that has facilitated subsequent redesign efforts. New process improvement efforts typically began from scratch, analyzing and modeling again, as if the process had never been previously analyzed and improved. Equally frustrating, the management group that revised the process was often a different group than the IT group that automated the process.

BPM Suites are designed to create permanent models of business processes. In fact, the models actually control the processes when they are executed. Thus, a BPM system is a permanent process model that is used on a daily basis, and can, when the time comes, be changed and improved. Similarly, most BPM Suites are being designed to be used by both managers and software developers. In effect, managers help create the models and use monitoring data from the processes, as they are executed, to manage the processes. Software developers work with the same software tools to define exactly how software applications can be integrated to facilitate the process goals the managers specify. In effect, the creation of BPM systems initiates a new era in the way business managers and software developers work together to manage and improve processes. Instead of starts and stops, as teams switch from one project to another, BPM Suites make it possible to begin a spiral effort that manages the accumulation of knowledge and guarantees that subsequent efforts will always build on past efforts, thereby reducing future costs and facilitating faster and more efficient changes when processes need to be updated. Smart firms will use BPM Suites not only to improve and integrate their current processes, but to lay the foundation for a more agile and productive approach to managing process change in the future.

3 Key Drivers and Objectives

Now let's consider some of the reasons why a company might adopt BPM in a little more detail.

3.1 Lower Business Costs and Increased Efficiency

A fundamental law of economics is that, when everything else is equal, organizations will naturally gravitate towards the lowest cost approach. When one thinks about the role of technology (and the IT department), it has always been primarily focused around driving efficiency – indeed all systems fundamentally aim to deliver on that objective.
BPM products generally support the automation of repetitive steps, integrating application systems as needed, and supporting complex decision-making. As a result, they provide a platform upon which firms can lower their fundamental operating costs while enhancing the value delivered. Some products incorporate sophisticated mechanisms to provide management with key metrics on process and team performance facilitating better utilization of available human resources.

### 3.2 Increased Adaptability, Flexibility, and Nimbleness

More and more organizations are discovering that their ability to roll out new products and services is significantly inhibited by their existing systems, processes, and organizational structures. Existing systems have become ever more brittle and difficult to change. Effective BPM infrastructure will allow the firm to develop new products and services far more quickly than was previously possible.

By **wrapping** the core functionality of existing systems (and existing processes), developers can reuse their capabilities in new processes without affecting the legacy application. This allows the firm to insulate systems from each other, yet seamlessly incorporate them into a new composite process. This **ring-fencing** of core application functionality also enables legacy applications to be swapped out and replaced piecemeal, without affecting new applications based upon them.

### 3.3 Lower Cost of Systems Development and Support

Modern BPM products provide increased developer productivity, significantly lowering the cost of systems development. For example, in one case study example, we found that instead of needing a team of 25 developers for 9 months, a UK-based parcels business needed just 4 people for 2 weeks to build customized extensions to their existing CRM system. Similar stories can be found in organizations looking to extend and customize existing applications. Today, virtually all functionality of any application can be reclaimed and reused in new BPM-enabled applications. But one thing is certain, as soon as an application is introduced into a production environment, the requirements of the users start to evolve.

Enabling the adaptation of these systems without recourse to expensive IT resources lowers the cost of ownership. Indeed, one of the key aims of most BPM Suites is to enable expert end-users to develop, adapt, and modify their business processes, along with the business rules that relate to them. As a general rule of thumb, the more a system can enable the users themselves to develop and deploy their own processes, the lower the cost of ownership will be for the resulting application.¹

### 3.4 Lower Systems Implementation Risks

Business executives are simply not prepared to put up with further expensive systems implementation failures. A litany of failed ERP, Supply-Chain Management (SCM), and Customer Relationship Management (CRM) projects have cast doubt on the ability of IT to deliver viable support for the business. BPM technologies provide a better way of organizing the IT development effort. By modeling an entire process and then making incremental, evolutionary changes, managers are able to introduce change with lower risk.

### 3.5 Better Governance and Compliance

Around the world, governments are introducing more and more regulations. Most are already familiar with Sarbanes-Oxley and the Patriot Act in the US, while in Europe, it is Basel II and the new UK Companies (Audit, Investigations and Community Enterprise) Bill.

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¹ For example, in one environment we assessed for a major British Bank in the early 90s, changes to automatic letters used in the process had to be made by the IT department. As a result, the average cost of changing a letter was £4000. Today, we would expect BPM systems to use modern word processing applications. Such changes would not require the involvement of an IT specialist.
But these are just the tip of the iceberg in terms of what Compliance actually means. Realistically, Compliance includes the full range of how a business is run against the guidelines, policies, procedures, and practices that exist at every level of the firm. From a legal point of view (i.e., responding to regulation), compliance can range from the appropriate disposal of waste and hazardous materials through ensuring that staff is trained sufficiently to handle the work they are given.

Then there is the operational risk to the core brand of the firm. Seemingly small deviations in corporate governance and policies can have dramatic financial implications for the core brand. Ineffective internal controls can also be very expensive, as Allfirst – the Baltimore subsidiary of Allied Irish Banks – discovered. In 2002, it lost $691 million because of one rogue trader and inadequate internal controls.2

Since BPM technology can impose a way of working on employees – controlling the ways in which decisions are made and modifications to the process are introduced -- it represents a critical enabler in ensuring compliance and effective governance. But a balance is required here. BPM products also provide the underlying capability to support a rigorous audit of what actually happens. With the right sampling and review procedures in place, it is possible to allow flexibility in the way processes are interpreted, while ensuring that the firm honors its compliance obligations.

3.6 Better Customer Service

By shortening cycle times and ensuring that customer interactions are handled effectively, firms are generally able to drive up revenue and lower costs (fewer errors mean lower costs). Secondly, BPM technology enables firms to integrate their various customer interaction channels into consistent, joined up processes. In a sense, it provides the glue to tie together disparate channels of customer interaction, ensuring that cases of work are not lost, and, at the same time, increasing the value delivered.

They also make it easier to respond to variations in customer behavior. Customers do not always follow a nice, neat pattern. They want it their own way. Since BPM products can support multiple paths through a process, Customer Service Representatives can respond to the subtly different needs of the people they deal with.

4 Analyzing Your Company’s Need for BPM

While we can point to a number of common goals and objectives of BPM initiatives, it would be naïve to assume that all companies and industries share the same problems. There are several ways of categorizing the needs of firms – by industry, by the type of workers who will be affected, by size of the firm, by the firm’s technological infrastructure, or by focusing on the specific processes you are considering for BPM.

4.1 Industry Sector

There is a big difference between the core processes and needs of different vertical market sectors. For instance, it is hard to find a process within a Telco that is not already largely automated in some way. In Financial Services, most processes are oriented around the controls required to manage risk. Manufacturing businesses are mostly focused on the optimization of the supply chain and on meeting customer orders in a timely fashion, while in many governmental agencies it is hard to find a process that is optimized to meet the needs of the true customer. Many in the state and federal planners are now looking at BPM technology to support them as they transform their processes to be more responsive.

BPM vendors respond to this challenge with industry and application specific frameworks or templates that sit on top of their basic product offering. These niche application templates often give users a head start,

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2 Reported in “Running With Risk”, McKinsey Quarterly, 2003 #4
allowing the customer to implement a viable system extremely quickly (in a few months) and then adapt the delivered processes to meet their individual needs.

The emphasis of vertical sectors also tends to favor different approaches. For example, in Financial Services, a primary goal for many firms is to ensure control and standardization of all processes. Yet, at the same time, the competitive environment often forces changes in processing rules on a daily basis. They do not want an employee to get creative with a bank draft. Moreover, because of their size, they need the capability to smooth out the peaks and troughs of work in the system, dynamically load-balancing the organization, while ensuring work is distributed to suitably qualified employees. To effectively utilize the resources at their disposal, managers need key performance metrics, right down to the level of the individual worker. So, for these businesses, audit and traceability are extremely important, along with rigorous control over the way in which change is introduced to the system. Management Information is critical, as is the ability to align skill level to the task in hand. On the other hand, those involved in other vertical sectors do not necessarily have these same issues.

4.2 Types of Workers

Traditionally, business software applications have been used to support the structured needs of Back Office workers with standard processes that integrate the workers with their supporting systems. In the Back Office, processes tend to be imposed as Procedures that are designed for efficiency and control, guarding against fraud and enforcing regulatory requirements. Generally, in the Back Office, it is assumed that processes change relatively little, while all sharing a common process model.

On the other hand, the requirements of Customer Service Representatives and those in the Front Office are quite different. Front Office workers require much greater flexibility to deal with the changing whims of customers and external entities. Customers seldom follow a standard course of activity and have a nasty habit of creating unplanned exceptions.

Knowledge workers are generally poorly served by BPM technology (yet they are so important to the success of the firm). For knowledge workers, processes are usually based on unwritten best Practices that are ingrained in the modus operandi of the core of the organization. They act more as a guide, and they need to develop as required by the business situation – reflecting an evolving business relationship, a refined understanding of a particular problem, or a greater pressure to fix some perceived problem. Empowered knowledge workers usually exercise their judgment in uncertain situations, meaning they need much greater control and ownership over the way things are carried out. Deploying BPM technology to support knowledge workers necessarily involves enabling their processes to evolve: The issue is not control, but the challenge is to enable reuse and change. This implies the need for knowledge workers to feel comfortable adapting (or selecting) procedures for their own use in the context of the case of work in hand. At present, it is very rare to find technology products or approaches that are naturally oriented towards the needs of knowledge workers. Indeed, we believe that this is an area where we will see the most product innovation in the future.

Of course, most organizations have all of these three quite different types of workers. Yet firms continue to look for a single product on which to standardize BPM infrastructure. If that is your intention, then we would suggest that you concentrate on products’ capabilities to enable change, since that will be one of the keys to supporting the widest range of usage scenarios. Inevitably, as soon as you

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3 There are a variety of strategies taken to deal with the needs of front office workers – these are explored more fully elsewhere.

4 Notice that we are deliberately using the term Practices to describe the processes of Knowledge Workers. This is in stark contrast to the Procedures that are imposed in the back office. For more on this discussion see “The Split Personality of BPM.”

5 For the sake of simplicity, we regard the process support needs of Executives as similar to those of Knowledge Workers.

6 For a wider discussion on the design strategies for process adaptability, see the section on Detailed Analysis.
have implemented a system to support your business processes it will require modification – no matter how much analysis you do in advance.

4.3 Businesses Size

Most of the products that get the headlines are oriented toward the needs of the major businesses. At the same time, however, 53% of available workers are employed by Small and Medium sized Enterprises (SMEs). Numerically, this group represents 86% of firms and is largely ignored by vendors in the BPM arena who are targeting the larger firms who are more likely to be early adopters.

4.4 Types of Business Processes

When companies first embark on a process-oriented journey, most tend to focus on the Procedural end of the spectrum (Back Office), only to discover that Practices are the real challenge (Knowledge Workers). While the notion of a neatly ordered process aligns with repetitive transactions, it does not truly reflect the reality of the real world. When knowledge workers interact with customers, they seldom follow the predicted behavior. The well-known 80-20 rule certainly applies – but it is even more complex.

Depending on the business context, one usually finds that the large majority of cases follow the expected pattern. This is typically around 70-80% of cases, which, because of procedural efficiency, consume about 20% of the available resources. The problem is that the other 20% of cases usually consume 80% of the available resource. Some of those cases can be handled through well-understood business rules, while others require a greater degree of collaboration.

Figure 1. Distribution of Cases has a profound effect on the suitability of one product over another. In a process driven production environment, virtually all resources go into handling exceptions

Small percentages of cases are truly unique and are usually handled outside the accepted system. Looking at this general issue another way, a relatively small percentage of the customers tend to consume the lions’ share of resources and can dramatically affect profitability. Reducing the top two tiers in the pyramid can have a dramatic affect on the business bottom line (i.e., standardizing the process).

But, in some situations, that is just not possible or practicable. Moreover, these numbers change depending on the business context and nature of the work. For example, imagine a support system for a group of Architects developing new building designs and remodeling interiors for customers. The system needs to help them track their projects and related documents, relationships with various sub-contractors, and interactions with local authorities who provide related planning permissions. Looking across the work in hand, one would find that the distribution of cases would probably be far more varied than the picture above would imply. The Project Bid process might initially have only 50% of cases following the core pattern (if there were such a thing), with perhaps a further 25% handled through
custom rules designed into a support system beforehand. All other cases would seem to require bespoke solutions that would have to be invented by the users. The system would have to facilitate end-users in adapting the process models underpinning their work. Such flexibility could be achieved by enabling them to add process fragments to the parent process description for the case in hand. This library of process fragments would probably cover a wide range of potential scenarios and additions.

While this may appear a radically different problem from that faced by many businesses, the fundamental design approach is core to success in a wide variety of different scenarios. Leaving it to the individual users to add functionality to support the case in hand enables a far more flexible and adaptable environment overall. Suitable controls are enforced by ensuring that these changes are limited to selecting from a library of pre-developed process fragments.7

The problem with processes is that they are not always as you would expect. For example, most people outside of Insurance Claims would imagine that the processes used are relatively standard. Yet often, depending on the culture of the firm, quite the reverse is true. In the words of the Head of Claims at Commercial Union: “Every claim is an exception.”8 He was lamenting the fact that insurance claims processing is inherently unpredictable. We could probably easily find another Insurance Claims business that would argue that, indeed, all claims-handling in their business is highly standardized.

5 How Vendors Position Themselves in the Market

5.1 Generic Product Positioning

There are at least two ways of thinking about how vendors position their products. In one case, we focus on their overall business strategy. In the second case, we think about the technology in the product. Let us start with a discussion of the former.

A popular way of modeling the business strategies was defined by Michael Porter in his classic book, Competitive Strategy.9 In that book he suggests that there are really only three generic positioning strategies: Differentiation, Overall Cost Leadership, and Focused strategies. Figure 2 shows how Porter explains the three generic strategies. Some companies seek to offer the best generic product. They charge a premium, and expect customers to pay it to acquire what everyone perceives as the best all-purpose product available. Porter refers to this strategy as Differentiation. We tend to refer to it as the “best generic product strategy.” A second possible strategy is to go for volume sales. Companies pursuing this strategy offer a good product and sell it for less money than their rivals. This is the Overall Cost Leadership or “lowest price strategy.” (Note that you can not effectively pursue this strategy with a poor product. Companies will not pay less for an inferior product. What everyone would like is the best possible product for the least money.) Finally, there is a focused, or industry or domain specific, strategy. In this case, a vendor specializes in a specific niche – in insurance industry applications, for instance, or in supply-chain applications. Vendors positioning themselves this way seek to charge a premium while avoiding competition with the industry-wide market leader. They do this by allowing another vendor to occupy the market leader position, and they seek to charge a premium by offering special value to customers with a specific set of problems.

We have already noted that the current market for BPM suites is relatively immature. Most customers still do not know exactly what features they need in a BPM suite, and most vendors are still exploring the mix of features that will prove most popular. In such a market, all the vendors tend to position

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7 See the section on Detailed Analysis for a wider discussion on Case Handling approaches.
8 Commercial Union is now part of Aviva, the 5th largest Insurance group in the world, resulting from the merger of CGU and Norwich Union.
themselves as the best product for every possible company. There are not that many sales, and every vendor wants every sale it can get. Also, the really large vendors like IBM and Microsoft are usually slow to enter a new market. They wait until the market becomes more mature, and they spend time ensuring that the products they eventually offer will be compatible with their other products and with their infrastructure offerings.

IBM and Microsoft are just beginning to roll out their BPM suites. In a year or two, when their products are established and they start to spend larger amounts of money to market their solutions, the smaller vendors that have dominated the BPM suites market in the last few years will begin to thin out. A few will have established themselves as serious contenders, and they will continue to position themselves as industry-wide, generic BPM suites. Most of the other BPM suite vendors will move toward a focused, niche strategy. In essence, BPM vendors who have been especially successful selling to insurance companies will add insurance-focused templates, frameworks, rules, or software components to their offerings to make them easier for insurance companies to use. They will charge a premium because their frameworks or components will make it faster and therefore less expensive for insurance company managers and developers to develop insurance processes using their products.

As you read the reviews of the various products, you will see hints of early moves toward niche specialization. Some vendors already mention that their products are especially popular with specific industries. Others offer extensive support for the development of specific types of applications; for example, Chordiant has considerable strength in the development of CRM applications.

As we suggested earlier, the BPM suites market is still in the immature phase. Most companies are not yet ready to build extensive BPM applications, although there are the beginnings of dramatic growth in the sector. The large contracts that occur when major companies decide to standardize, companywide, on a specific BPM suite are only just beginning to happen. In the meantime, the vendors are evolving their products as rapidly as they can, in an effort to become the best possible generic BPM suite, while simultaneously charging a premium price. Put a different way, it is too early to point to specific products and suggest that one product is best for insurance applications, while another product is the product to use for heavy manufacturing process automation efforts. We expect that the 2006 survey will begin to report a more specialized market.

5.2 The BPM Technology Continuum

Now let us consider the technology that a vendor might include in its product offering. In effect, this is just a more specialized way of talking about market positioning. Figure 3 provides a picture of a BPM
An Introduction to BPM Suites

Product Continuum. On the left, we show BPM languages, like BPEL and Java. On the right, we show BPM-enabled applications or systems that are ready “out-of-the-box” to support a specific type of process.

Obviously, if you start with a language like Java, you can build any kind of BPM system you want. But it takes a lot of work, using only a language, to build a system. You need to start by developing all the utilities you normally find in BPM Suites – a modeling environment, employee forms generators, a BPM engine, and so forth. It requires a considerable programming team to develop a BPM application from scratch. Contrariwise, if you buy an application that is ready to run, you do not have to do much development, but the application is set up to manage a very specific set of business processes (e.g., a Call Center, Supply Chain Procurement, or Loan Approvals) and is really not fit to do anything else. Most companies opt for products that lie between the extremes, buying packages that provide more than a language, but less than a completed application. We have divided the continuum in-between into Servers, Tools/Utilities, BPM Suites, and BPM Suites + Frameworks. As you move from left to right, the products become more structured and provide more ready-made components, making it easier and faster to develop finished applications. Similarly, you pay less for a language, more for a tool, still more for a BPM suite, and considerably more for a finished application, reflecting the additional work that has gone into each successive level as you move to the right on the continuum.

Languages provide the maximum flexibility and require the most work to get to a complete BPM system. These products are invariably used by IT developers.

BPM Servers

Vendors who sell languages, like BPEL or Java

BPM Suites

Vendors who sell EAI/BPM server platforms

Tools/Utilities

Vendors who sell stand alone tools or utilities. For example: Proforma & Casewise sell process modeling tools, Ilog & Corticon sell business rule tools

BPM Suites + Frameworks

Vendors who sell BPM Suites

Complete BPM Applications

Vendors who sell complete BPM systems or applications.

Applications provide the minimum flexibility and require the least work to get to a complete BPM system. These products can be used by business users.

Figure 3. The BPM Product Continuum

There are lots of packaged applications for sale. The difference between a conventional application and a BPM-enabled application is that the BPM application incorporates the elements found in a BPM suite. This means that the user can examine the process used in the application and the rules used to make decisions, and change them, as needed. In other words, a BPM application is defined so that users can examine the underlying process models and can modify the decision rules used in the application.

A BPM Suite includes a generic set of modeling tools that expert users, business analysts, and developers can use to specify a process that will be managed by its Engine at runtime. Some companies have created BPM Suites from scratch, developing each utility or tool in conjunction with every other. Others have created their BPM Suites by writing some utilities themselves while acquiring or licensing other tools or utilities from independent vendors. Thus, for example, about half of the BPM Suites on the market today do not include a native Rules Engine. Instead, they have licensed their rule engine from one of the Business Rule Management Tool vendors, and then embedded it in their BPM Suite. Similarly, some of the BPM Suites have recently replaced their earlier, native process-modeling tool with a process modeling utility acquired from a Process Modeling Tool vendor. In effect, the BPM Suite vendor switched its modeling utility to provide its users with a friendlier and more versatile process-modeling environment.
Similarly, some vendors use Microsoft’s BizTalk to provide the enterprise integration engine for their Suite. Some even divide up the BPM engine, using a workflow-derived engine to handle interactions with employees and an independent integration engine to manage software applications.

To be clear, BPM Engine, as we use it in this report, always implies managing the execution of the process (model) and its interaction with employees. The BPM Engine may also handle the execution of software components used in the process. Some tools separate the BPM Engine, which handles the employee interactions, from the enterprise application integration (EAI) server or engine that manages the software component, creating, in effect, a BPM Engine and a separate EAI engine.

A BPM Suite vendor might package applications-specific knowledge with what is otherwise a generic tool. Thus, a BPM Suite might come with a Supply Chain framework that provided a generic process model of a supply chain process, and/or a set of rule bases for making supply chain decisions. Predictably, as the BPM Suites market becomes crowded and more competitive, some BPM Suite vendors will specialize in particular types of processes or in specific industries and tailor their tools to make them better for the development of one kind of application or another.

5.3 The BPM Stack

Figure 4 provides a slightly different way of looking at the BPM product market. It really makes the same point as Figure 3, but it does so in terms of a stack of software layers, rather than a continuum. In effect, Figure 4 is Figure 3, viewed at right angles.

![Figure 4. A layered view of BPM products or utilities](image)

Each layer sits on top of a lower level, using technologies defined at the lower level while adding additional utilities to integrate the levels below, to provide a more general functionality.

The key thing to keep in mind when you look at Figure 4 is that a company could develop a product or suite by developing its own tools and utilities and engines, or it could do it by assembling products that others have developed, incorporating them into its BPM Suite or BPM Application. Consider Figure 5, for example. Here we illustrate how a hypothetical BPM Suite might be assembled. Assume that the vendor wrote its own Process Modeling Tool, a User Interface utility, and its own BPM Engine, all in...
Java. Then it placed these on top of IBM’s WebSphere Business Integration Server, which, in turn, incorporates BPEL (highlighted in brown). In this case, the BPM Suite combines some proprietary code and some code that it has licensed from IBM.

Let us go further and assume that our hypothetical BPM Vendor created some process models for common insurance company processes and sets of rules that were commonly used in insurance company processes, and packaged those with the tool. This would result in a BPM package that was particularly productive for managers and developers in the insurance industry. And it would place the product a little to the right of many BPM Suites on our BPM Product Continuum.

In essence, vendors who emphasize server technologies are aiming for an industry-wide position. Vendors that end up sitting on top of Microsoft or IBM platforms and incorporating industry specific templates or frameworks are already moving toward a focused niche strategy.

6 What Features Might a BPM Suite Include?

Figure 6 provides an overview of one possible architecture for a BPM Suite. It shows both the key elements and various supporting elements.

As we review the products described in this report, we will consider each of the elements pictured in Figure 6. Moreover, we will consider the same topics in the same order each time to make it easier to compare the products.

Product Overview

We will start each review by briefly characterizing the overall architecture that the vendor has used and what features it supports. Within this section, we will try to highlight the unique points about the products and its implications for process architecture and deployment.
BPM Engine

Next we will turn to the BPM engine included in the BPM Suite. We will focus on how the vendor has divided the elements among server and client platforms, the repository that it uses.

We will consider how the system accesses employees, how the employee (user) interface is generated, and how well the engine can scale to handle large number of users. We will consider how the suite manages software components and integration.

Process Modeling

Next we will consider how the vendor’s product supports process modeling. In conjunction with modeling, we will consider if the product supports simulation. We will discuss the interface that is provided to develop process models and how the semantics of the product support subprocess models and reuse. We will also reflect on how the product supports the forms, time, and simulation.

Business Rules

We will follow a general discussion of process modeling with an examination of support for business rules, if the support exists. We will consider how rules are used, what kind of rule entry and management interface the tool provides, and how the rules are managed at runtime.

Integration

Next we will focus on how the Suite works with other software applications and databases used in a business process. We will discuss integration in two senses – linking in other applications to a process model, and how the product facilitates reuse of its own functionality in other applications. We will also consider Web Services where applicable.
Organizational Structure
All products reviewed use some representation of the organizational structure to drive distribution of work. We will discuss the approach taken and its implications.

Process Adaptability
Since it is impractical to assume that all cases of work will follow the standard pattern, we explore how the system can be changed to support the needs of the case of work in hand. This also includes discussion on how the Engine can support more flexible Process Architectures.

Process Lifecycle
We move on to consider how the product supports the ongoing maintenance of a process once it has been defined. We are really looking for mechanisms to allow the firm to protect and enhance its process assets.

Monitoring
We next look at how the tool captures data about events that occur at execution time – what facilities are provided to analyze, filter, or summarize that data, and what capabilities the tool has to generate manager dashboards to present that data to process managers.

Templates and Frameworks
We will also consider if the BPM Suite comes packaged with any industry or domain specific templates or frameworks that make the Suite especially useful for the rapid modeling of specific types or business processes.

The Vendor
We go on to briefly describe the vendor and its size and position in the market.

Costs
Finally, we will consider the cost of acquiring the BPM Suite.
A Detailed Analysis of BPM Suites

In this section we provide a more detailed discussion of each of the areas we will consider when we describe specific BPM Suites. Once again, we will follow the same outline that we will use when we describe each vendor’s product.

We start, in each case by providing the names of the product and the vendor, the version number, and contact information. If the product information was updated for the 2.0 release, we indicate that with UPDATED. If the company and product were added for the 2.0 release, we indicate that by marking the review NEW.

1 Product Overview

The Product Overview sets the scene and communicates the core product features that differentiate the product from its competitors.

2 BPM Engine

We continue our analysis by describing how the tool is organized to manage business processes. Most BPM Suites are organized around client-server or multi-tier architectures. The repository of process models and the core BPM engine usually live on a server that provides infrastructure support to developers, employees, and managers who access the server via Web browsers. Traditionally, vendors provided a desktop client environment that was loaded on the PCs of employees and managers, although most now use the Web browser for this purpose. The vast majority of vendors still provide a desktop PC-based process modeling client for use by developers and business analysts.

The Server Environment

Different vendors describe their BPM engines in different ways. We also have to reflect the multiple, overlapping middleware technology products and acronyms. The term Server is a generic term that is used to describe either a software component that performs some specific purpose or a piece of computer hardware that provides shared resources to a range of Client machines. Within this study we generally mean a software component of some kind.

Most environments make use of a modern Application Server from one of the major IT vendors, such as Microsoft, BEA, or IBM, although a few have developed proprietary approaches that do not use this infrastructure. An Application Server is a software product/component that dynamically generates Web pages. Over time, the Application Server products have taken on more and more responsibility for managing other software requirements such as load-balancing and clustering support for applications.

The BPM Engine is another type of Server. The BPM Engine or BPM Server is responsible for executing, controlling, and monitoring all business processes. It orchestrates events within and across multiple processes. The BPM Engine handles employee interaction, routing work to employees, and ensuring that the work is accomplished (managing the state of the case of work). In the past, this functionality was often described as workflow management.

The BPM Engine is usually also responsible for coordination of third party applications into the process and manipulation of process-related data (which is normally stored in an enterprise-level database system such as SQL Server or Oracle).

When integrating third party applications we find a number of approaches. The BPM Engine may employ a distinct EAI software component or Integration Engine; it may reuse functionality provided by the Application Server; or it may directly invoke the external application, using that product’s Application Programming Interface (API). In some products, the core process engine is separated from
another internal component that handles the integration of third party applications. A wider discussion of Integration follows later.

The BPM Engine is generally responsible for allocating resources, ensuring thread-safety, and deallocating resources and database connections at the conclusion of a transaction (some of these tasks may be supported by Application Server). Technically, two approaches predominate to provide transactional integrity, security, scalability, redundancy, and dynamic load-balancing. Either the product relies on a scalable set of components, such as Microsoft .NET or J2EE (focused around the Application Server), or the core engine is subdivided into a wider group of interoperating proprietary components that achieve a similar aim.

![Diagram of BPM components]

Figure 1. The Application Server may also provide the EAI support needed, or there may be a separate EAI engine.

Most products rely on a direct connection between modeling tool clients and the BPM Engine that stores developed processes models (in its own proprietary repository). When BPM applications are executed, they generate large amounts of information on specific process instances or cases of work. All of this information, both modeling constructs and runtime data, is then stored using established database products such as Oracle or SQL Server.

**Client Elements**

Users normally access their work items through an Inbox application of some kind – either directly via a standard Web Browser (via a custom plug-in), and/or via email notifications which then take the user directly to the relevant work item via an embedded URL.

Apart from the browser-based Inbox application, most vendors provide separate user interface capabilities for systems administration and process monitoring. These are often integrated within the same environment in which users access their work, although they can exist as stand-alone tools.

Developing process models and enhancing them for the runtime environment can also be thought of as an additional user interface. We explore this aspect more thoroughly later. These process-modeling tools are sometimes accessible in a browser environment but usually require a proprietary desktop PC client.

**Web Services**

We are now seeing widespread adoption of Web Services. Web Service functionality usually provides support to the developer in one or more of the following ways:

- To support the integration of external applications: As long as the external application is exposed in terms of Web Services, it is fairly straightforward for process modelers to integrate the desired functionality into a process application (see Integration)

- To re-use existing process models in a service oriented fashion (as an invoked subprocess) and also to similarly make the current process reusable. (See Subprocesses)
- To facilitate the development of a Shared Data Space: By introspecting and importing the WSDL of a Web Service, the process developer can rapidly develop a framework for the relevant contextual data required by the process. (See Shared Data Space)

- To allow an external application to query and report on the status of process instances.

- As an adjunct to Business Activity Monitoring functionality, where the system invokes a Web Service to alert (or invoke a process) should a metric or SLA go past/over its alert status (whether that be over time, too many work items in a queue, etc.).

- To expose the administrative capabilities of the product, allowing work to be reassigned, or starting and stopping processes/servers.

- To allow the functionality of the BPM Engine and associated repository of process models to be accessed by (embedded within) external applications. The range of support in this area can vary widely.

Some vendors are starting to incorporate support for the Business Process Execution Language for Web Services (BPEL4WS – usually referred to as BPEL). BPEL was initially developed by BEA, IBM, and Microsoft and is currently going through a final ratification by OASIS. BPEL is an open, interpreted XML-based language that can be used to drive process execution in a BPM Engine. However, for all practical purposes, BPEL is limited to managing software applications. Without further extension, it cannot support employee interactions – although a future version of the standard probably will.

At the moment, BPM Engines that rely on BPEL as the native execution language are rare. Indeed, within the products comprising our study, only IBM talks about native BPEL language support, and that discussion very quickly drops into proprietary extensions (somewhat negating the rationale for a standard execution language). What is far more common is the capability for a BPM Engine to import a BPEL definition and then translate that into its internal process definition format before executing it (using the proprietary features of that BPM Engine). Although this sounds like a subtle difference, it is important. Buyers should understand and clarify the vendor’s support for BPEL and its implications for the way in which applications can then be constructed.

### 2.1 Platforms

Different products or elements require different software and hardware environments. Companies that rely on Java and use WebSphere or WebLogic will probably prefer a BPM Suite that is tailored for these environments, while companies using Microsoft Server will probably prefer a BPM Suite tailored to rely on Microsoft Server. A few engines run natively on both J2EE and Microsoft environments. Companies that rely on specific databases for their enterprise work will want to know which databases different BPM Suites require or support.

### 2.2 User Interface

The industry standard these days is a web-based browser such as Internet Explorer or Netscape. Sometimes this is supported by a plug-in for the browser which allows the user to load different views of their Inbox. This is often combined with email to deliver work notifications to the user’s normal email Inbox. Each email embeds a URL that launches the browser to take the user directly to the appropriate item.

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10 BPEL is somewhat constrained in other areas as well. For instance, it has no support for Transactions, Business Rules, Task Management, Mobility or Human Interactions. Despite these weaknesses, the market has chosen BPEL as the execution language going forward (primarily because of the support it has received from the major vendors).
Most vendors also support their own proprietary, thick user interface clients. These tend to be used for so-called heads-down or power-users. Some products support the ability to embed the process Inbox within Microsoft Outlook.

Increasingly, we are finding that vendors are directly supporting Portal technology, providing standard Portlets that can then be embedded in any portal environment. The prevailing standard in this arena is JSR 168. This specification defines a set of APIs for Portlets and addresses standardization for preferences, user information, Portlet requests and responses, deployment packaging, and security.

Other technologies employed in this area include DHTML and XHTML support and use of the Jetspeed portal framework (which should include support for JSR 168 later this year).

Either way, out-of-the-box user interface functionality is still composed of relatively standard tabular views of work to which the individual has access (based on Role assignment or shared access to Queues). Other customizable views may include information on completed work items, or the ability to search for cases of work and drill down on their status.

2.3 Scalability

Most products rely on the container provided by J2EE or .NET for scalability, enabling a single logical BPM Server to be split across several machines in a cluster. At their hearts, the engines tend to be multi-threaded, with some using an advanced stateless process execution model ensuring that the server components do not needlessly consume machine resources. In virtually all cases, information required to track the state of a business process is persisted in the database.

Some vendors have off-loaded part of the server functionality (normally work queue management or monitoring) into discrete components that can be replicated and/or distributed. This has the effect of moving the processing requirement closer to where it is needed, leaving the central logical process engine with less work to do (and hence greater scalability). Where work queues have been distributed, the product tends to depend on a reliable messaging infrastructure (such as JMS or WebSphere MQ). In a couple of products, a separate integration engine is used to marshal resources from third party applications, removing the strain from the core logical server.

Those that have chosen to work outside of the J2EE or .NET application server infrastructure have greater control over how components are distributed across a cluster (although they then need to manage the whole environment within which the server operates). In these situations, it is often possible to have multiple BPM Engines that are configured to interoperate (running either centrally or in distributed locations). Master-slave relationships are relatively rare, although they are more common in those products that have a long pedigree. A few products have the capability to survive node failures in a cluster without impacting the capabilities of the engine.

3 Processing Modeling

This is the area where the effective capabilities of the product are most apparent – it is where the semantics of the vendor’s interpretation of process are made visible. A key issue here is the degree of accessibility of the environment and the amount of IT specialist support required. Looking at the user interface of the process modeling application often gives a good idea of what is delivered out-of-the-box (rather than requiring the development of suitable programs).

Virtually all products claim that end-users can develop their own processes, but this is usually just a first step. What is normally meant is that business analysts or expert end-users can develop procedural definitions – the Activities of the process, the Order in which they are carried out, and the Roles to which work is assigned. Typically, process models are then tossed over the fence to IT developers who extend and further develop the process description, making it ready for deployment by suitably authorized personnel.
In some products, the business analyst and expert end-user are provided with a distinct process modeling environment, allowing the vendor to simplify the user interface for this group of users, yet still deliver rich functionality to meet the needs of IT. In such scenarios, developers then build on these relatively simplistic process models, converting them into deployable solutions integrated with LOB databases, electronic forms, business rules, other processes, third party applications, etc. This sort of functionality is normally beyond the capabilities (or interests) of the end-user population.

However, this points to a critical issue for BPM environments generally – balancing the sophistication and capabilities of the process support environment with user accessibility and control over processes. There is a trade-off here. Some vendors have chosen to leverage widely used modeling tools such as Microsoft Visio to alleviate the problem.

Either way, the greater the involvement of specialist developers (IT specialists), the more time is required before any desired changes are introduced. As a general rule, the more development end-users do for themselves, the lower the total cost of ownership. On the other hand, greater care and control can be exercised over changes to the system by specialist IT developers. Certainly it is a good idea to ensure IT involvement in the design of the overall process architecture (how all the processes fit together).

One of the key challenges is the integration of third party applications. While this is explored more extensively in a later section of this report, integration capabilities are worth noting in the context of a discussion on end-user accessibility to process modeling. To get around this problem, the expert developer is often given the capability to develop custom tasks (often called activities or nodes) and place these on the modeling palette for use by the business analyst. These tasks are already pre-integrated with the surrounding technology infrastructure (facilitating reuse of existing IT assets).

And then there is the question of access. Who should see and edit individual process descriptions? There is normally a fair sized team of people working on a project. Again we see a range of capabilities delivered in the modeling and system building environments:

- In the majority of products, users deal with each model individually. There is no prospect of two or more users interacting with the model at the same time.
- Another group of vendors have implemented a proprietary, multi-user repository that facilitates the access of several users to the model at the same time. There is a downside to this level of sophistication; it usually means that it is impossible to work on the model unless one is connected to the central repository. Some get around this through a check-in/check-out approach to the management of process models in the repository. Security is provided either on a named user basis within the repository, or via a role-based mechanism implemented via a Directory Server. (See Organizational Structure)
- Other vendors support the situation where the repository only covers one project (where a project encompasses a series of models associated with a given solution). This approach supports the situation where an individual may want to take responsibility for the project in the early stages, yet still enable multi-user access at a later date.
- Another approach to this problem is to implement a bridge to enterprise oriented modeling repository tools. This allows multiple users access to process models in the third party environment (where the modeling repository manages all access to individual objects). Initial implementations tend to be uni-directional, where the BPM Engine imports process information from the third party repository. Problems can then arise in making those models ready for deployment. A lot of rework can be required when small changes in the process must be embellished with proprietary extensions required by the BPM Engine for effective operation.
A two-way bridge normally removes the need for this sort of rework, with tighter integration between the modeling repository and the BPM engine.

Either way, once a process model is deemed complete, it is published to the BPM Server. Of course, some vendors support more than one of the above approaches.

And then there is the problem of complexity and completeness. In the past, products provided little or no support for the firm in trying to spot and resolve errors that may creep into process models. These can include business rule conflicts, collisions, gaps, overlaps, inconsistencies, or redundant processes. However, it is now quite common to see validation and testing functionality built into the modeling environment (often referred to as a pre-production simulation capability).

In the past, virtually every product had a proprietary modeling notation. The semantics of their environment was thus inextricably linked to their modeling tool. With the advent of an industry standard process-modeling notation, the Business Process Modeling Notation (BPMN) from BPMI (www.bpmi.org), we now see vendors starting to adopt this standard graphical notation. Indeed, a few of the vendors we have looked at within this report have fully BPMN compliant modeling user interfaces. Most vendors who have adopted BPMN have yet to release versions that support Compensating Transactions and role assignment through the use of Pools and Lanes. Over time, we expect to see more vendors adopt this approach.

### 3.1 Subprocesses

Most products incorporate the ability to handle subprocedures as part of the overall process model. Indeed, it is around subprocesses that vendors tend to incorporate opportunities for flexibility in process architectures. Precisely how this is done and the resulting process architectures that are possible vary a great deal. Again, we find a range of approaches:

- The simplest level is really little more than a graphical construct to simplify process models (often called Submaps). Effectively, the subprocess is embedded in the parent process. When a case of work following the parent model arrives at the Submap, control is handed to the subprocess to complete before control is handed back again. Sometimes, the product allows a Submap to be called from a variety of places within the parent process (further simplifying the construction of the parent).

- Another approach is to develop a library of subprocesses, which are then copied into the parent process at design time. Effectively, the end result is the same as the situation above, although reuse is facilitated through the library function.

- A more flexible approach is to call the subprocess at runtime, with only the reference to the specific subprocess linked in at design time.

- The most flexible approach is to allow the call to the subprocess to be decided at runtime – either programmatically by the engine, based on some business rule, and/or by humans involved in the process exercising their judgment on what is required.

Calling subprocesses as stand-alone Process Objects has both advantages and disadvantages. On the one hand, it allows loose coupling of processes. Individual process fragments are developed independently of each other, allowing much more flexible process architectures. Individual processes are insulated...
from the functionality of other application areas. Think of such Process Objects as Services in a Service Oriented Architecture. (See Figure 2.) On the other hand, it means that more work is normally required up front to ensure that the Process Objects product is robust and capable of operating in a variety of different situations (the developer does not necessarily know to what future uses the process might be put). To get around this issue, some products support both embedded subprocesses (where the subprocess is copied into the parent at design time) and the calling of stand-alone subprocesses (subprocesses as Process Objects).

Further sophistication is possible when one considers how the subprocess is called. In some situations, the usage scenario requires that the parent process wait for completion of the fragment (we sometimes refer to this synchronous behavior as triggering the process). Alternatively, the parent is not concerned with what happens to the child (we often use the term spawn to describe this asynchronous behavior). It kicks off the child process and carries on.

Furthermore, it may be necessary to instantiate the subprocess a given number of times. For example, if the parent process were collecting budget information from a variety of corporate subsidiaries, the parent process would probably spawn a separate subprocess for each. The parent might then wait while each subsidiary formulated and posted their responses (which might, in turn, instantiate further processes in each subsidiary). At a later point, the parent would want to re-synchronize with each of its spawned process fragments, incorporating the returned figures into a corporate budget. Using the trigger functionality in this situation would mean that if one subsidiary did not post its response, then the whole process would grind to a halt (which may not have been a desirable outcome).

Further sophistication is possible through the use of arrays as process variables in the Shared Data Space (see next subsection). In this situation, an array is populated with information relating, for instance, to each subsidiary. A different subprocess could then fire for each subsidiary. This method would be effective in handling the needs of a, say a marketing campaign. Overall process support for the campaign is required, integrating cleanly with different processes for handling each customer who responds (each with potentially different requirements).

Subprocess constructs can also be used to implement goal-seeking behavior in the process. When the parent process arrives at the point where the subprocess is defined, it evaluates the needs of the process...
against the available Process Objects, instantiating those that meet the criteria of the parent. This sort of functionality is usually found in separate Business Rules Engines, but is sometimes found in the BPM Engine. (See the section on Business Rules for more information.)

When we look at how a Process Object is called, at the technical level, this has traditionally been done in a proprietary fashion (i.e., each vendor has invented its own approach, based on a database reference or directly invoking byte code). With the advent of Web Services, this mechanism is now becoming standardized (indeed, we would be surprised if all vendors do not quickly support this method). Assuming that the vendor has gone down the Web Service route, a process can be published as Web Service and can also consume Web Services. This allows any process to call a Web Service enabled subprocess, either by programmatic conditional action or through human decision at any step in any process. Moreover, a process running on one BPM Engine could make use of process functionality running on another.

Thinking about subprocesses, one also needs to keep in mind how Line of Business (LOB) data is managed between the parent and the child. A few products provide specific facilities to ensure that these are consistent; some provide validation mechanisms, others support a mapping facility where the elements of the parent are matched to the capabilities of the child. Another approach is to base all subprocesses on specific templates that already have a Shared Data Space defined. Most leave it to the developer to spot potential conflicts.

### 3.2 Shared Data Space

When looking at the product’s capabilities with regard to managing information, one needs to remember that most process models integrate third party applications and capture information associated with the case.

All products provide facilities to create variables of some kind and associate them with the process model. These variables are really placeholders that are populated with information as the case moves through the process model (either programmatically from third party applications or via direct user entry). This information is then available to support automatic decision-making, or is presented to users in electronic forms, or saved back to a LOB application. Alongside these discrete elements of data, there may also be documents of virtually any sort.

Collectively, we refer to this capability as the **Shared Data Space** (SDS) of the process model (our term). This is all about how the BPM engine manages context. Data gathered at one step can be reused at another. As far as the case of work is concerned, related information is available (stored in the supporting RDBMS, rather than extracted every time it is needed), allowing data to be pushed or pulled to and from third party applications. It is worth noting that the information itself probably belongs to (is persisted in) some third party application and must be flushed back to the correct transaction based system.

While virtually all modern BPM products provide a Shared Data Space of some kind, often this is limited to the discrete variables associated with the case. However, some offer more extensive capabilities associated with how the product handles other types of content. Here we are referring to the letters, attachments, and other documents. Indeed, the ability to manage processes alongside the content to which it refers is at the heart of some of these products.

As we noted earlier, a key capability to watch out for in this area is the ability to support an array concept. Arrays provide an important construct necessary when designing more flexible process architectures. Arrays can be supported in various ways, either as a direct variable type, a pointer to a more complex object, or even through a spreadsheet.

Another feature that has started to emerge (with the more modern BPM Engines) is the capability to quickly construct the required SDS structure by reusing the data structure of either an associated Web
Service or an existing Form of some kind (HTML, InfoPath, PDF, ASP, JSP, etc.). Indeed, if the application is to integrate a third party application, then it can often make sense to first wrap that functionality within a Web Service and import the WSDL structure for the process. Some products also provide the capability to selectively map the WSDL of a Web Service or Form structure to the existing SDS (using a graphical tool).

3.3 Forms

In most products, electronic forms are used to present and gather information (handled by the Shared Data Space and any underpinning LOB applications). Some vendors provide proprietary thick client forms environments, although most now employ browser-based approaches. Often we find that a default form generated by the system can then be adapted and modified in the form-building environment of choice.

Depending on the overall architectural orientation of the vendor, you may find support for a range of form types including JSP, ASP.NET, HTML, PDF, InfoPath, ActiveX, etc. Some of these products also allow for drag and drop creation of forms and the graphical linking to process variables. Accessible functionality in the modeling environment is a key enabler toward lowering the cost of ownership of developed applications.

3.4 Time

BPM Suites vary quite a bit in their handling of time. Usually it is perceived in terms of how much time a Step or Activity has to reach completion before some escalation or error condition is activated. Escalation is normally handled via email notification (to a specified role) or by placing the work item in some special queue visible to the supervisor. Some vendors include several levels of escalation and/or the ability to manage specific server side error conditions.

However, one could think about other requirements for time handling. When a step is instantiated, is this time value set relative to the time that the case of work was instantiated, or when the last task was completed, or in relation to some fixed (target) end date or other date related variable? From a business rules perspective, one might also have time related conditions based on a fixed point (e.g., collect all timesheets from employees on Friday afternoons, start the production run only if goods can be delivered by Saturday between 10 and 11 am).

A few products support highly distributed business operations with all time references calculated back to Greenwich Mean Time (GMT) – also known as Universal Time Clock (UTC). This enables engines and workers in different time zones to see time references in their own local time.

3.5 Process Optimization & Simulation

Some products include a bundled simulation engine that allows process owners and developers to assess the impact of process changes. These facilities aim to identify potential bottlenecks, project time, and the costs of specific processes or activities, and to optimize the overall flow of the processes.

While this is an admirable aim that appeals to most managers, it is worth mentioning that simulation models can be misused. Too often we see people building deterministic models that are designed to try to determine how much money will be made as a result of a process change. Such models usually bury their underlying assumptions. It’s far better to surface and examine simulation assumptions.

Another factor to keep in mind is that most products that have bundled simulation capabilities normally limit the scope to a single process model. Of course, this does not reflect the real world in which such processes would operate. In a sense, business processes compete with each other for the resources of the business. People are usually involved in a great many different processes, and it is difficult to accurately represent their switching behavior or the impact of one process peak over the performance of
another. Of course managers often make similar mistakes when they seek to redesign processes in isolation.

Given these qualifications, simulation can be very useful. Furthermore, it is becoming much easier to employ simulation in support of overall process optimization efforts. In the past, constructing effective simulation models required significant skill and resources. One needed to define exactly the resources that were consumed by each activity, the hours that these (human) resources were available, and the probabilities that a case would travel down one path or another (using one of many available statistical methods). One also needed to ensure that the behavior of the simulation model reflected the real world. Most companies that used simulation found that they needed a simulation specialist or consultant to obtain useful results in a reasonable amount of time. Moreover, it took a lot of effort to gather the supporting data to validate the model.

All of that has become a lot easier now that the simulation capability is directly reusing the process models of the BPM Engine. The Engine also gathers all the necessary data to support model validation. Rather than having to guess what sort of statistical method was needed to approximate the real world, the simulation tool can now directly reuse existing history data from cases in the system. One can now explore the impact of re-assigning resources from one part of the process to another.

Of course, this information is only relevant where the process itself has not changed fundamentally. Simulation, by itself, usually does not provide insight into ways one might improve a process. Most of the innovations that result in the optimization of processes result from people sitting down and discussing with each other what will work best, what is unnecessary, etc. No tool will automate the generation of ideas.

Note that some vendors use the word simulation to describe a pre-production testing and validation capability (designed for process developers). In these situations, the model is exercised by the BPM Engine to support the developer in spotting errors and problems with the underlying process and its integration of external applications. Some of these products also feature what if scenarios and other analysis tools to identify improvement opportunities, prior to deployment.

4 Business Rules

Business Rules can mean different things to different people.13 Certainly, different vendors interpret the need for business rules quite differently and have differing objectives. Business rules within a BPM system can be used to support the automation of business decisions, to structure loose informal business practices and policies, or to apply rigorous sets of conditions that can help business analysts and domain experts express the essential requirements of the system behavior. For others, business rules are limited to a set of conditions that control specific business events. In a process, business rules are the components that implement the decision-making logic.

All BPM products allow conditional routing – where a transition between Activities/Steps carries with it a condition. If the condition evaluates to true, the process follows that path (often creating a fork in the process). Depending on the approach taken by the vendor, the condition is not placed on the transition between Activities, but is instead placed on the Activity itself (think of it as a precondition that must be met for the Activity to become instantiated).

Indeed, constructing process definitions based on such preconditions is a very powerful way of reflecting the true needs of the process, without unnecessarily inhibiting the overall pattern of work. In some situations, the process need not be as neatly ordered, as one would initially expect. Certain parts of

13 For the purposes of this discussion we will limit ourselves to discussing business rules within the context of BPM initiatives.
the process could be carried out in any order, while other Activities can only be done once certain conditions are met.

In many businesses, the rules are far more complex than can be easily represented with simple conditional statements. Although it might be possible to represent all possible paths through a moderately complex process with conditional statements, the resulting process map would become almost unintelligible. As the complexity increases, it becomes more difficult to represent the necessary logic with conditional statements. As one vendor put it, “The problem with detailed process maps is that their graphical nature, while initially of high value to promote understanding, loses their value as complexity increases. Even when following best practices for mapping, the effort to follow graphical flows (and understand the details behind the pictures) is too great. Instead of promoting clarity and understanding, they increase complexity and confusion.”

To get around this problem, some vendors have built sophisticated business rules features into their core product. The overall aim of business rules functionality is usually to enable business users to interact with the system through English-like rule-based statements (rather than getting too involved in all the complexity of procedural modeling tools).

For example, a rule might be “If the customer has a good credit rating, then apply the fast track loan approval process.” This might combine with “If the applicant is an existing customer and has never defaulted on a repayment, then assign a good credit rating.”

One can store rules in a database and manipulate them with a database management system, but complex rule systems are usually managed by a Rule (or Inference) Engine that evaluates the rules at runtime. Briefly then, we can describe the ability of a product to manage rules in terms of three possibilities, each able to handle more complex logic:

- Constraint-based systems.
- Rule systems that manipulate a rule set with a database management system.
- Inference-based systems that can evaluate rules at runtime.

Independent of the technology used to evaluate the logic of a set of constraints or rules is the interface that a developer uses to create and evaluate rule sets. Most developers find it easier to enter rules via a spreadsheet-like interface. More complex systems can require each rule to be entered separately via a rule editor.

From the user interface point of view, BPM Suite vendors that have developed their own business rules capabilities have normally employed a spreadsheet metaphor. Users describe the condition using Boolean logic, exceptions, events, and the values of variables attached to the process instance (when modeling, this is based on the structure of the SDS). If the condition evaluates to $true$, then the engine moves the work item to the process state described in the spreadsheet, bypassing the procedural core of the process. The same sort of functionality can also be used to bind in selected subprocesses.

Initially, most BPM vendors integrated stand-alone third party Business Rules Engines (BREs), allowing the vendor to respond to the requests for business rules functionality of potential customers. Over time, we have observed that some of these BPM vendors have since extended their own product offerings to support more fully the business rules functionality.

Given a rapidly evolving business climate and a related set of business rules, there are profound implications for audit and compliance. Indeed, the whole notion of lifecycle support for business rules development, deployment, and eventual replacement is of concern. Who should have access to
designing and changing business rules. While all systems require certain levels of authorization to change and adapt rules, firms employing this functionality still have to be rigorous about how the capabilities are deployed.

Business rules facilities also aim to simplify process maps, pushing the complexity into the specialist rule handling functionality. Others see the addition of business rules functionality as a way of enabling on-the-fly evolution of the process model. Instead of developing a robust process model that reflects every possible path, business rules are used to provide an incremental process development capability. Given the volatile nature of business processes, it is often difficult (if not impossible) to capture all of the necessary details prior to implementation.

Still another use of rules is in providing superior management over how work is distributed to employees. Given the raft of scandals in the financial services industry relating to mis-selling of products, regulatory bodies are insisting that only suitably qualified (trained) personnel should undertake certain tasks. In these situations, the rules must factor in the current organizational structure and the skills (and quality indices) of the employees within it. (See Figure 3.)

When considering business rules capabilities, firms should keep in mind that as the complexity of the rule set increases, system performance (scalability) of the resulting application often deteriorates. Similarly, scalability is impacted by the number of variables considered by the rule set. On the other hand, with certain sorts of applications and the falling cost of computing power, this may not be a problem.

Another issue to keep in mind is that as the number and complexity of rules increases, it becomes increasingly difficult to determine the validity and completeness of the overall system. Further, it becomes increasingly difficult to see how a given business objective is reflected in a set of rules.

Those companies that conceptualize their processes in terms of rules will want a BPM Suite that supports the use of rules during process execution. Companies that already have independent rule systems may prefer to keep existing rule systems and simply link the BPM Suites, but many will decide that they want rule capabilities integrated within their BPM Suite.

5 Integration

In the past, Integration was the Achilles Heel of process-based systems. Integration at the back end could consume an inordinate amount of time and resources (representing as much as 50% of the cost of

\[14\] Quite how this sort of functionality fits into a control-centric view of Sarbanes-Oxley legislation is open to interpretation. Some would argue that it directly opposes the aims of such regulations, while others would maintain that, with suitable controls and safeguards, the benefits outweigh potential disadvantages.
A Detailed Analysis of BPM Suites

ownership for a process enabled application throughout its effective lifespan). However, advances in technology over recent years have transformed the integration landscape. EAI and Messaging Oriented Middleware (MOM) products pushed the boundary considerably. In the past few years, XML and Web Services have enabled a quantum jump in the productivity that is achievable. They have simplified the task of integrating even the most complex application, lowering the bar of technical expertise required. Now, a business analyst with a basic understanding of XML can integrate most applications. The introspection of Web Services leading to rapid development of a Shared Data Space for the case, along with graphical tools for mapping variables onto that structure, have allowed non-programmers to undertake much more of this sort of work.

Those products that have a legacy from the EAI and Workflow domains still tend to require specialist IT support. Products that have emerged more recently tend to concentrate on the XML and Web Services route (rather than bespoke scripting).

Some products delegate the integration challenge to a separate Integration Engine. And some BPM Suites leverage existing integration facilities of their host environment. For instance, in the Microsoft arena, virtually all products make use of Microsoft’s BizTalk Server 2004 (a .NET environment). Some vendors deliver their own bundled Integration Servers which work closely with the core process engine of the BPM Suite. Examples are IBM’s WebSphere BPI Server (a Java environment), TIBCO with BusinessWorks, and CommerceQuest’s TRAXION.

When linking in third party applications we can see three distinct levels of sophistication:

- **Brittle Spaghetti** – Some leave it to the process (software) developer to write suitable programs. Most application vendors facilitate this with sophisticated API sets that allow developers to pass contextual information to the third party application. But this can result in what we have come to call brittle spaghetti where disjointed external program calls are peppered throughout process definitions. Over time, the management of this integration code becomes a nightmare as back-end systems change and the process models themselves evolve.

- **Adapters** – A more sensible approach is to develop standard interfaces to these applications through which the process communicates with the backend application. Sometimes called Connectors, a whole industry has sprung up with third party software vendors providing Adapters to major enterprise applications such as PeopleSoft, Siebel, and SAP. While much better than the brittle spaghetti described above, they do have limitations. Purchase an upgrade on your SAP system and you will likely need a new set of Adapters to go with it.

- **Introspection** – The best approach we found was a self-generating adapter facility that is driven by automatic service discovery. The interfaces to third party applications are wrapped to create a set of reusable components that are then made available for use in process models. Known as introspection, the developer explores the methods and properties of the target application via its API set or a Web Service interface. Selected methods and their properties are then wrapped with an executable program, which connects to the target API and, through it, to the back end application (creating reusable components).

Some vendors make these components available on a modeling palette as pre-integrated, custom Tasks that are then dragged and dropped onto the modeling canvas, as needed. Others catalogue them and make them available as a set of discrete integration objects that are sewn into the back end of system-oriented task types, as needed. This latter approach is preferable as it normally includes mechanisms to manage the library of components, making sure they are available, as needed, on target systems.

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15 This figure is based on research undertaken during 1996 around a 33,000-seat deployment of workflow technology in a large retail bank and related anecdotal evidence gathered at the time.
Either way, this introspection approach allows specialist IT developers to ensure that components work effectively, yet delivers an environment that sophisticated end-users can access without having to resort to coding. Moreover, it provides a better way of managing the interface to third party applications, insulating them from each other and the process environment. Change the back end system and all the developers need to do is re-introspect the application – the process model and end-user application need not change at all.

**Reusing BPM Engine Functionality**

Another aspect of integration is the need to allow a third party application to reuse the process functionality of the BPM environment itself (i.e., the exact opposite of the above need). These options are most relevant to ISVs looking to process enable their existing applications, or major end-users looking to develop custom user interfaces for specific categories of employee.

This sort of requirement is normally implemented via a published API set (of the BPM Engine). Products vary greatly in their overall approach, although we are now seeing more use of Web Services in this area.

Some products expose key elements of functionality as a set of standard objects at the client level. An alternative is to provide access to functionality via a server-side model – COM, C++, Native Java, RMI, and EJB flavors are common.

**6 Organizational Structure**

An essential feature of any BPM solution is the ability to route work items to the correct person. In order to do that, the system must know about the organizational structure and the way in which processes interact with it. At the simplest level, process definitions reference roles or queues. In some way or another, the BPM environment associates individuals in the company with these roles/queues, allowing the engine to resolve routing decisions and push work through the system to the appropriate people.

But allowing the process to reflect the companies, divisions, departments, sections, job functions, groups, matrix reporting structures, and communities of interest within an enterprise is a little more challenging. And the complications only increase when you consider that the notion of process is no longer limited to the boundaries of the enterprise; the scope now extends up and down the value chain, incorporating customers, suppliers, and partners. How do I route the work item to the supervisor of this person? Who should have sight of the current state of the process instance? How do we route work to our partner (yet allow them to own their own parts of the process)? How much work can this individual user (or team) handle, and what skills do he/she/they need to carry out the work? All of these types of questions require some notion of organizational scope and structure.

**Proprietary Approaches**

In the past, vendors had to provide their own capabilities in this area, building proprietary notions of organizational structure into the product. Some products had a very simplistic approach (with just shared queues to which users are assigned). Others used roles (assigned to the queues) with an independent structuring of roles to reflect either the reporting structure of the business and/or abstract roles representing a type of work carried out.

**Directory Servers – LDAP & Active Directory**

While the BPM environment may have its own proprietary data stores to reflect the organizational structure, integration with an industry standard Directory Server is now becoming the norm (at some level). Directory Servers can be used to maintain information about the structure of the organization and, sometimes, its customers, partners, and suppliers, making this information available to a variety of
applications. The Directory Server stores the assignments between employees and roles (either abstract or organizational reporting based).

Directory Servers come in two fundamental flavors: The open systems version is LDAP (Local Directory Access Protocol), whereas Microsoft has its own Active Directory (AD) Server. Most products now incorporate a capability to reuse this information.

It is worth noting that there is a marked difference between end-user firms when it comes to the understanding and use of AD and LDAP technologies. Larger firms have embraced the power of these environments to underpin a variety of systems initiatives, whereas the vast majority of smaller firms have done little more than distinguish between systems administrators and end-users. For many firms, it is challenging to build and maintain a comprehensive model of the organization along with all of its complex reporting structures and teams. This usually requires considerable attention in many BPM initiatives.

As we will see in one or two of the product reports, getting control of this area is critical to achieving ongoing productivity improvements. Without an accurate organizational structure, it is impossible to deliver effective management information or operational performance data.

When it comes to making use of a Directory Server, we find a number of distinct levels of use:

- **Import Organization Data**: The majority of vendors simply import this information (into their own internal structures) and then enhance it with proprietary information to reflect a richer diversity of organizational forms than those one tends to find in a typical Directory Server deployment.

- **Reusing Organization Data**: Rather than import organizational information, these products directly reuse the data recorded in the Directory Server for routing decisions. They tend to provide tools to modify the structure of the information held in the Directory Server, adding further categorization mechanisms.

- **User Authentication**: Some products not only use the data for routing decisions, they leverage the Directory Servers inherent capabilities for user authentication. This can be taken a stage further and applied to authentication for access to associated content repositories.

- **Deployment**: Although not covered in the products reviewed here, we have also seen vendors that use the Directory Server to support distribution of applications to the appropriate part of the organization, ensuring that the necessary components, processes, subprocesses, and third party application connectors are deployed to the correct local servers.

## 7 Process Adaptability

In this section, we consider the underlying capabilities of the BPM Suite to support adaptation of processes at runtime. This sort of functionality is inextricably linked with that covered by the next section, Process Lifecycle Management.

Over the last 70 years an enormous amount has been written on how organizations “get things done.” Two broad approaches are apparent. At one extreme, individuals are controlled (to the nth degree). Workers only carry out tasks as instructed. At the other extreme, workers are empowered. In this case the workers share an understanding of the vision, goals, and business rules of the organization. Empowered workers tend to work independently of management with little or no control imposed from above. In reality, most organizations adopt a position somewhere in between these two extremes. Different groups (within an enterprise) are usually in different positions along this spectrum – usually based on an individual manager’s style and circumstances, rather than on any conscious decision on the part of the firm’s management.
These issues point towards one of the critical issues for BPM deployments. How does one achieve that fine balance of control and empowerment, varying the stance to reflect the needs of different parts of the organization and distinct phases of activity within the process? Empowered cultures have disadvantages with respect to control and communications, although the benefits, in terms of overall adaptability and flexibility, can be enormous. However, when one looks at the products and BPM implementations, most reflect management’s preoccupation with control, often resulting in highly mechanistic process architectures that reduce organizational flexibility.

A critical point, often overlooked, is that, prior to the selection of supporting BPM technology, managers should consider the organizational and cultural context of the firm. The capability of those environments to support end-user adaptability of the process is critical. No matter how much analysis is carried out up front, the process models used to drive the business will almost certainly be required to change very quickly. Moreover, individual cases may present unforeseen exceptions.

Products vary considerably in support for the challenges of change. We have always maintained that BPM environments reflect the views on organizational behavior held by the original software developers. The products varied considerably, based on whether the vendor thought the problems were all about control of employees or, at the other end of the scale, whether they sought to enable knowledge workers to achieve their goals.

Moreover, one of the key challenges in a process driven production environment is that all the manpower is spent handling exceptions (rather than the instances that follow the standard, automated pattern of work). If you do not have an effective way of handling each exception (for that particular instance), then it rather defeats the purpose.

![Figure 4. The majority of approaches rely on multiple work items sharing a common process model; the process is primacy and the work item is secondary.](image-url)

Most products start from the position that all changes must be reflected in the process model a priori (beforehand), and that, at the simplest level, all work items of a given class share a single process description (rather than copying the model to support each work item). In such situations, the engine will normally allow the end-user little or no choice, and no option to step around the pre-defined procedures. The end-users are restricted to entering information; any exceptions are gathered up manually by a supervisor who may have the capability to bypass a step in the process or cancel the work item. In such situations, the supervisor will normally need separate access to any third party applications. Very often, the supervisor becomes the bottleneck as cases mount up that do not seem to follow the rigid pattern laid down beforehand.
Change is, of course, possible through re-development of the process model. New cases of work will then follow the modified process description (most products incorporate some form of version control to support this transition). Change to an individual case requires that all threads of work be deleted and the case recreated at the appropriate point (compromising any future audit).

The core problem with this underlying approach is that all possible permutations of the process must be predicted in advance – something that is virtually impossible to achieve. To get around this situation, some products incorporate features that provide the ability to bypass, redo, and rollback steps.

A more flexible approach is to develop what has become known as a Case Handling environment. Although it is rare to see out-of-the-box support for this, it is often possible to enable much greater adaptability through the use of advanced process architectures. Effectively, a parent process is used to support the overall case. End users (and/or the system) select the appropriate process object from a library, which is bound into the parent at runtime to reflect the needs of the particular case in hand.

Traditionally, this selection was achieved with a library of subprocesses (submaps) embedded within the parent process. While somewhat effective, this design was not as adaptable as one based on distinct process objects maintained independently of the parent process. The latter approach enables each process object to be developed and maintained independently of the others.

![Diagram of Case Handling systems](image)

**Figure 5.** Case Handling systems allow multiple process objects to be associated with a given case of work; primacy is with the case, rather than the process.

The advantage of this approach is that process developers can then concentrate on the essential path of the process, leaving it to end-users to exercise their own judgment. Products in this category normally incorporate a pre-condition function that allows developers to build in checks that ensure corporate policies are enforced. For example, in an insurance claims situation, this sort of flexibility would enable Customer Service Representatives (CSRs) to follow any number of paths through the process, yet would still allow the firm to ensure that the claim went through appropriate approval before any payments were made. Such systems offer users great flexibility while also allowing the firm the greatest level of control. Each process object is developed in advance and is tested (often by the specialist process developers) to ensure that it functions appropriately. It is also worth noting that with the advent of Web Services, we are likely to see more and more Case Handling type process architectures.

The highest level of adaptability in Case Handling is enabled when end-users have the ability to create their own personal process fragments and apply them selectively within an individual case. New process

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16 See the Business Case For Case Handling at [http://www.enix.co.uk/caseman.htm](http://www.enix.co.uk/caseman.htm)

17 This sort of design approach is possible with a few of the major BPM environments, leveraging the flexibility offered around the way in which subprocesses are called and instantiated. It will usually require great care in the design of the process architecture itself, and may involve the development of an external application.
objects are defined by the user, as needed. Alternatively, they are copied and refined from existing templates and bound into the parent. The user is now able to interpret the task in hand, invoking a private/public process object to undertake the work. Suitably authorized users then have complete control over the process definition. Process models evolve as users adapt existing definitions or as new fragments are added when required.\textsuperscript{18}

While this last level of adaptability might appear to many readers to be outside the scope of a BPM Suite, it is essential for a whole class of applications. It would be most relevant in project-oriented environments and where knowledge workers must continually exercise their judgment – examples would include software development, architecture, offshore oil and gas exploration, and advertising. Each scenario is unique, yet the benefits of process reuse are massive.

The precise mechanisms used to enable adaptability rely on the underlying architecture of the BPMS and whether it can handle more than one process associated with a work item. With a couple of notable exceptions, products use a single process model to support all cases of a given class. Some have sought a halfway house where the a priori model drives work, but, when unforeseen exceptions occur, the process instance is referred to the process owner (or suitably qualified expert) who adjusts the business rules to reflect the needs of the case in hand. The process model is effectively modified through the business rules, allowing the case in hand to continue.

Those vendors that have elected to copy the process model for each case of work generally have a much more flexible and adaptable stance. They can truly respond to the needs of individual work items without having to revert to changing the original process model. Indeed, most products that do not support this approach assume that exceptional cases can be neatly erased from the system and then restarted with the new version of the process, which, in turn, affects audit ability and traceability.

\section{Process Lifecycle Management}

One could say that all BPM suites provide some degree of support for the lifecycle management of business processes. Indeed, supporting that lifecycle from the initial vision, through modeling, deployment, execution, performance monitoring, and modification, is at the very core of most BPM initiatives. In the past, we have seen mechanisms that solicit input from key people and record reasons for changes made to models.\textsuperscript{19}

However, products vary significantly in their support for lifecycle management. What we are particularly interested in here is the ability to track the lifecycle of a process model, supporting the organization as it optimizes the process over time. Given the need for BPM products to support an adapting, evolving business climate, lifecycle management of a firm’s process assets is a critical area that is generally poorly supported by most vendors.\textsuperscript{20}

Virtually all products provide an administrative console to facilitate and control the deployment of process models. While it is normal for the process developer to have the right to publish his or her own models, some organizations look for more precise control over this aspect (allowing them to apply quality assurance and compliance tests to the production environment).

As we mentioned earlier, most BPM environments support some sort of version control of the business process models. Some take this a bit further, with an ability to transparently support the deployment of

\textsuperscript{18} This degree of flexibility is even more rare than Case Handling. None of the products reviewed in this study provided this type of functionality.

\textsuperscript{19} Although almost totally unrelated to BPM technology, a useful methodology that can help alleviate this is Issues Based Information Systems or IBIS. See the open-source initiative at \url{www.compendiuminstitute.org}

\textsuperscript{20} This requirement is distinct from the ability to simulate process models and carry out what-if analyses.
different versions and variants of a process, depending on some specific factor. For example, imagine a bank and its credit approval process. It would need to support subtly different processes in different geographies, organizational units, or through different channels. The deployment mechanism of the product would then need to ensure that different versions and variants of the process are deployed to the right places.

In some products, the administrator has an option of overwriting an existing published process (effectively replacing it on currently running cases of work). However, most insist that the new version of the model is used to drive new cases of work, while the older model is maintained until existing cases have completed.

Generally, products leave it up to the systems administrator to worry about how these models evolve and how older versions of the process description are managed. Apart from that, support for the company managing its process assets is delegated to third party repository-oriented modeling tools. A couple of our vendors in this study have used associated functionality, such as business rules or the content repository of their engine, to manage the way in which processes are deployed and managed.

9 Monitoring, Measurement, and Management Information

Many senior managers have embraced the idea of BPM deployment in hopes of obtaining better information about their business processes. They want the ability to look into the end-to-end profitability of a product or service, drill down to assess, compare and contrast the impact of one channel over another, and to see how individual departments are performing against Service Level Agreements (SLAs). They want the ability to track and monitor their business, identifying teams that are failing or to spot quickly any bottlenecks that are impacting performance.

Virtually every BPM solution we looked at promoted the idea that, by using that product, customers will get better management information, but, once again, different vendors mean rather different things.

Consider Figure 6. As events occur, data about them are stored in a database (a History File). A monitoring utility can use that information to provide feedback to employees (1). It could, for example, tell them how many work items they had to deal with in the past hour. Some BPM Suites are set up to generate reports, usually relying on some 4GL system. Thus, a system might generate a report for the supervisor or the supervisor’s immediate manager that would tell how many units were produced per hour, per employee (2). This same or related data could be used by the BPM Suite or by IT managers to monitor and adjust the performance of the BPM software, redirecting work, as needed, to alternative resources.

21 Clearly, there are consistency issues associated with replacing the process model used by cases that are in existence already. The current process state of a case may become invalid. Products that support this sort of replacement option should also include a search option to ensure that all existing cases of work are in a valid state.
We hear vendors say, “The history file provides all the audit information you will need – a complete history of the work item, including who handled it when, etc.” Usually, this audit information is limited to a description of work items, changes in activity state, and information on who handled it. A couple of vendors have taken this sort of information several steps further. For instance, M1 Global maintains not only a history of the changes at the activity level, but also of each interaction channel across a case – whether that is via call-centre, the web, or even instant messaging. On the other hand, eg work manager uses quality and compliance sampling metrics and skills to support tight production management disciplines that drive increased productivity.

Generally speaking, with the right information gathering and reporting regime, the business can more easily sense important changes in the market and customer behavior – changing the process, if necessary. Based on a better understanding of operational needs and capacity, managers can then make more informed decisions, adjusting resource levels in different departments – effectively load-balancing the business in line with peaks and troughs of demand. Users and managers can then view average process cycle times, which types of cases and activities take the longest, or even how long cases take to get to a particular stage. This information can then be used to find process bottlenecks and identify areas for improvement.

Other monitoring systems can make the data available online for the supervisor or the manager (3). Some, in effect, generate reports that the manager can access online, while others can provide the manager with real-time information about the events occurring in a given process.

The key thing to note is that (1), (2), and (3) all provide managers with more or less raw data. If the manager does not understand the specific activity or process, he or she will probably not be able to understand the data being generated. Moreover, the data needs to be limited or the volume of the data will overwhelm the manager.

More sophisticated monitoring systems go well beyond this. They combine the data resulting from a given process with other data from other sources. This is usually done by combining multiple data sources in a Data Warehouse. For example, one might combine data from the specific process with data...
from the upstream and downstream processes, or even from sales and customer satisfaction data. This data would be truly overwhelming if it were sent to a senior manager without being filtered. Most companies that are developing more sophisticated monitoring and management information systems, use Business Intelligence (BI) systems to analyze the data and to look for patterns. In addition, they use filtering systems and tailor the manager interface to present the information in a highly summarized format. This information is suitable for senior executives and strategy teams seeking to exercise high-level oversight or to determine the overall value of a business process (4). This is the approach that IBM uses in its WebSphere Business Integration Modeler.

At a minimum, users evaluating BPM Suites ought to ask if the suite is reporting data about the specific process, or if it is combining process data with other data, analyzing it, and filtering it to provide information for senior managers.

In the past, managers were left to reflect on their own special needs for Management Information. Developers had to write suitable programs to extract this information and present it to the appropriate member of management. But now we are seeing a far more systemic approach. Thus, vendors have begun to include Analytics functionality within their products.

Indeed, we even have one specialist vendor (e.g., Solutions Ltd) that focuses exclusively on delivering effective Management Information and production planning capabilities (on top of another BPM product). One should remember that there is a distinction between having process metrics available and using them effectively.

10 Templates and Frameworks

In addition to selling a BPM Suite, many vendors provide templates or frameworks that give the business a start point in developing specific types of applications. For example, a vendor could provide proprietary business rules for popular industry processes, or even offer software components to facilitate the development of a specific type of business process. Some go so far as providing support for entire applications focused on a specific vertical or horizontal application.

In a similar way, some vendors provide industry frameworks that define vocabularies and metrics for specific types of processes. ACCORD provides a framework for the insurance industry and the Supply Chain Council offers the SCOR framework for companies working on supply chain systems. The use of a framework or packaged components and rules can substantially reduce your development time. If you use a business process framework at your organization, it’s worth inquiring if the BPM Suites you are considering will support that framework as well.

11 Vendor

In each review, we briefly describe the vendor, noting its history, and its current situation. Everyone should be aware that the interest in BPM Suites is still developing. At the same time, the technology is evolving and new standards are emerging – while the majority of potential users are still evaluating BPM and have yet to decide exactly what features they will want in a BPM Suite. Of course, in such a dynamic situation, where innovation is still the watchword, most of the BPM Suite vendors are relatively small. This creates a volatile situation. Predictably, as the market grows rapidly in 2006, and then in 2007 or 2008, and as standards and technologies mature and companies settle on the features they want in BPM Suites, there will be a shakeout in the BPM Suites market. Thus, companies that are considering BPM adoption should consider both the technological sophistication of the vendors and their financial strength. These considerations may not be critical in 2006, if your company is simply buying one or a few copies to experiment with, but they will become critical when companies began to standardize and make more extensive commitments to specific vendors.
12 Cost

Finally, we provide basic information about how each vendor prices its product.
1 Product Overview

ACI WorkPoint is a comprehensive business process management (BPM) solution that enables businesses to react to change by improving their existing processes and systems. WorkPoint can be embedded as a component or used as a standalone solution. ACI WorkPoint Advantage offers the same strong BPM solution as WorkPoint with the additional benefits of an integrated business rules engine (BRE) that enables business users to graphically create sophisticated business rules. Both WorkPoint and WorkPoint Advantage offer a flexible, component-based architecture that allows users to model, validate, deploy, and immediately use new business processes. Each product coordinates all aspects of the process – people, resources, and systems into an integrated, efficient whole.

WorkPoint offers both native Microsoft .NET and native Java J2EE runtime engines, with the ability for both to be deployed in the same environment, sharing the same database. WorkPoint uses virtually any relational database as persistent storage for all process definitions and instances, including work status and history information. The product’s platform and database independence are the result of more than a decade of development and customer deployment.

WorkPoint's stateless runtime engine is comprised of a set of component services that execute and manage the overall process along with event management, system integration, process automation, and business rules. The architecture, open application program interfaces (API), and support for Web Services WorkPoint, a flexible, scalable solution with practically unlimited implementation options. Historically, this has appealed to a wide range of ISVs and OEMs who have embedded WorkPoint into their existing applications, effectively process-enabling them. But as the product has matured, it has evolved into a sophisticated stand-alone BPM engine.

In addition to its dual native runtime engines, WorkPoint offers a number of other interesting features. For example, each case of work is supported by a unique process model (copied from the original process description when the case is instantiated). Although this may sound relatively unimportant, this feature facilitates unusually flexible runtime adaptability, allowing modification to reflect the unique needs of the case in hand as exceptions occur. Indeed, the entire WorkPoint environment reflects the ability for controlled runtime adaptability. Subprocesses are instantiated and either bound into parent processes at runtime or can be instantiated to run concurrently and independently from the parent process. As a result of these features, the entire notion of process discovery becomes easier as developers can concentrate on the core requirements of the process, perhaps supported by some generic process fragments (subprocesses) to handle exceptional customer communications.

Another unusual approach taken in the design of WorkPoint is its uses of shared data space. Rather than importing all case relevant information into a managed set of variables, the WorkPoint design philosophy is to maintain all information where it belongs (in LOB and third party applications). On the other hand, the modeler can decide to retrieve data into contextual variables stored along with the WorkPoint case (for performance reasons, avoiding multiple extractions from an external source).
Other notable WorkPoint features include sophisticated support for looping and goals-seeking behavior that is needed in many types of processes (but is often difficult to implement). It also includes the concept of a condition; the engine monitors the environment for that condition and then can raise alerts, or trigger a new process. This is primarily used to monitor state changes within a process and design sophisticated escalation actions. However, this is taken a stage further when combined with the ability to monitor external conditions (i.e., where the engine can get data referenced in external databases), thus enabling the engine to sense changes in the wider information environment and take appropriate action.

2 BPM Engine

The WorkPoint engine offers both a native Java version based on the J2EE specification, and a Microsoft Windows version leveraging .NET. The Java version of the server components involves stateless Enterprise JavaBeans (EJBs) with some message driven beans. This stateless architecture along with the J2EE capabilities provides extreme scalability without sacrificing transactional integrity. The Microsoft version is similarly component-based, using the .NET framework for transaction support. The Microsoft engine has been totally .NET-based since the September 2005 release. WorkPoint fully exposes all functionality via published APIs, enabling everything from original process creation, through all business functions and monitoring. WorkPoint has two sets of APIs. The server API is stateless and is typically used when invoking WorkPoint from like components (i.e. EJB to EJB, .NET to .NET). The client API manages both the state and session, making it quite useful for thick client applications or thin browser interfaces.

![Figure 1. The Architecture of the Java-based Engine](image_url)

The EJB-based engine is tailored to maximize the benefits of the J2EE architecture (Figure 1), and is therefore deployed in the user’s choice of application server and managed in that environment. The Microsoft engine is similar within the .NET framework and uses the same underlying WorkPoint database schema for compatibility on all platforms (Figure 2). Along with the WorkPoint Java API, there is also a .NET API; the EJB System Services are replaced by a .NET Enterprise Library.
framework, and the database access becomes Active Data Objects/Object Linking and Embedding (ADO/OLEDB) oriented. The Microsoft engine is built on the Microsoft Enterprise Library and runs as a Windows Service for benefits such as automated start-up, remote monitoring, administration, etc.

Collectively, these APIs are used to access the component architecture, embedding process functionality within other applications. However, as mentioned previously, WorkPoint has evolved into an effective solution for end users to manage their own processes by using the supplied process modeling, monitoring, and gateway user interface functionality.

One of the system services is a monitor process that supports several WorkPoint features such as delay node processing, e-mail generation, alert monitoring, and asynchronous script processing. Each of these has a separate component that can have multiple instances running for scalability purposes.

From a Web services point of view, WorkPoint can use the approach to both integrate external applications and to embed process functionality within disparate legacy applications.

2.1 Platforms

Since WorkPoint has both a Microsoft and a Java runtime engine, virtually any application or database within the enterprise can be accessed and utilized/driven/integrated as part of a business process. Depending on the engine, WorkPoint uses either JDBC or ADO/OLEDB for connectivity. The WorkPoint database can reside on any SQL compliant database (i.e., it is SQL-neutral). Furthermore, WorkPoint processes can integrate any number of SQL data sources, even if the WorkPoint database does not reside on them.
In the Java world, WorkPoint needs Java 2 Runtime Environment, Standard Edition, version 1.4 or higher; JDBC 2.0 connectivity to a relational database and EJB application server supporting J2EE 1.4 or higher. In the Microsoft world, WorkPoint needs the .NET framework 1.1 or higher, and ADO/OLEDB connectivity to a relational database.

2.2 User Interface

WorkPoint can be deployed as a stand-alone BPM suite, complete with its own front-end gateway user interface, or it can be embedded within an external application. The integrated dynamic XHTML-based gateway allows developers to quickly deploy front-end screens and applications. The gateway screens are dynamically linked to steps in WorkPoint processes so that, as activities are modified, the screens automatically reflect changes. The XML tags used to integrate the gateway with WorkPoint are also used by customers to integrate their own content and context data in the user screens. A number of out-of-the-box gateway templates are provided. The recent forms builder function can be used to dynamically create forms that are automatically deployed to a portal (see section 3.3).

Figure 3. WorkPoint provides a number of XHTML gateway templates for rapid deployment

2.3 Scalability

WorkPoint consists of a set of components that can survive node failures if deployed in a cluster. The total solution can be configured with multiple instances of the components to meet the performance and scalability requirements of the enterprise. Customers can choose to run all of the components or only those that they need.

WorkPoint’s runtime engines are tailored to maximize the benefits of the surrounding architectural container or framework. The EJB version container is an EJB Application Server, and the .NET version framework is the .NET Enterprise Library Architecture. The runtime engine components take advantage of all the benefits of the container or framework, such as automated start-up, remote monitoring and administration.

Furthermore, the stateless architecture supports load balancing of transactions across multiple enterprise servers, providing linear scalability and a highly available environment. Taken together, these features make for a reliable and robust platform for applications with distributed business components.

WorkPoint’s individual components must have connectivity to the WorkPoint Server, but can be located on separate machines. The architecture then supports multiple instances of these components on the same or separate machines, as needed, to provide scalability.
1 Processing Modeling

The WorkPoint Designer (Figure 4) provides the graphical process development interface. This interface is designed to be used by both business analysts in the initial layout of process templates and by IT professionals to flesh out any necessary integrations with other applications or databases in the enterprise.

The WorkPoint Designer can be used to manage the process instances that are created from the process definitions (e.g., J. Doe’s personal computer order). The Designer can display multiple process definitions and cases at the same time. All of the Designer's functions are implemented using the WorkPoint client API, therefore, all or part of the Designer’s functionality can be built into other applications.

The graphical WorkPoint Designer application can run as a client application or as an applet within a browser. The applet is either in read only mode, or with read-write capabilities (i.e., locally installing the thick client modeling tool is not necessary). This functionality is employed by suitably authorized users to adapt individual cases of work at runtime, as necessary (see Process Adaptability on page 9.)

Process models are constructed as a series of nodes and transitions. The semantics support multiple start points for a process (any node with no incoming connections), which allow developers to define different start points for different channels. Nodes themselves can also carry pre- and post-conditions to support more sophisticated business rules.

![Figure 4. The WorkPoint Designer application is used for both modeling and monitoring cases](image)

The flow of the process follows all transitions that evaluate to true (transitions carry the constraints). A Transition Wizard (an expression builder accessing a range of general operands and the variables of the shared data space) was recently added to support the definition of constraints. WorkPoint’s constraints can be as simple as expressions built with the expression builder to customize rules built with the integrated script statement. Constraints can also use the embedded rules engine or integrate to the user’s existing rules engine.

To support the looping behavior required by many processes, the semantics include upstream transitions (special transitions that traverse back to an earlier point in the process). When evaluating transitions, the engine always looks first for upstream transitions. If they evaluate to true, then the process instance (or subprocess) is reset to the earlier node, and the iteration count is incremented (used to ensure that cases do not endlessly get stuck in a loop and to support later audit). Loops can be based on a single node providing goal-seeking behavior on the node until a certain condition is reached.
In WorkPoint, the delay node represents a pause or hold in a business process, with the delay based on a time period, a condition, or an event. It is also possible to specify the number of times an action should be repeated and the delay between repetitions. If the delay node is based on a condition or an event, the delay ends when the condition or event evaluates to true. This is useful in ensuring that a process has reached an appropriate state before moving on. For example, a delay might check that necessary physical resources are available before moving to a given step, or that more than one individual customer service representative has dealt with a claim before it can be passed for payment (to avoid fraud).

Once fully configured, a node can be saved as a template for later reuse. Developers can easily build a toolbox of fully configured activities that are then reused, wherever needed, throughout the system.

ACI Worldwide has built a link to the Proforma ProVision modeling repository. WorkPoint directly invokes the ProVision API to access the models stored in the repository.

ACI has also built a link to numerous third-party modeling solutions. WorkPoint either directly invokes the modeler’s API to access the models stored in the repository or converts the exported model from the modeler’s repository into WorkPoint’s repository. The standards supported by the modeler are, but not limited to, CIF, XML, xPDL, BPMN, and BPEL. This enables users to leverage their existing investment and take their process improvements to the next level.

2.4 Subprocesses

Any process in the WorkPoint modeling repository can be called and used as a subprocess. The subprocess is not tied to the parent process until it is instantiated at runtime (only the parent contains the link). Subprocesses can also be nested (a validation check is made to ensure that subprocesses are not nested within themselves). Moreover, any node type (including subprocesses) can be added to a running instance during orchestration. Of course, it is also possible to dynamically decide which subprocess is called through the use of context variables (which might be set programmatically or via user choice). Recent updates to WorkPoint include the split node, which gives the user the ability to invoke multiple copies of the same sub-process concurrently. The number of sub-processes instantiated can be determined at any time before the subprocess node is activated.

2.5 Shared Data Space

ACI has sought to support the best of both worlds. On one hand, they maintain all information where it belongs (in LOB and third party applications). On the other hand, the developer can decide to retrieve that data into contextual fields stored along the case in WorkPoint, which saves having to retrieve it multiple times from an external source.

Shared data space variables are named item pairs where the value can be text or binary. The current version of WorkPoint allows variables to link any object – whether it is an array, string, Java class, or anything in the system. The structure of the SDS can be built two ways, including statically, at design time (one variable defined at a time), or through the selection of database table fields (i.e., via the WorkPoint API).

WorkPoint can also associate a document to the entire process instance or to a single task within the process instance. These documents are typically managed by a document management application to which WorkPoint interfaces (virtually any third-party package or homegrown document management application) or can be contained in the shared data space area of WorkPoint.

2.6 Forms

The WorkPoint designer provides a graphical process design interface that allows users to create customer-facing forms for the instantiation of the process instance and for manual activities of the process model. The forms are auto-generated and ready for immediate use within the WorkPoint gateway.
The WorkPoint gateway provides a way to quickly deploy user-facing screens/applications. It requires no scripting yet provides users with a powerful platform for long-term production applications.

Developers can make use of the integrated dynamic XHTML-based gateway for the development of front-end applications. Alternatively, they can easily use the same XML tags to integrate their application content/context data if they choose to render their own content rich screens for their users.

### 2.7 Time

The delay node can be based on a fixed point in time or a period after the case or task is instantiated. These calculations can be based on business hours, if needed. Alerts define specific conditions to be monitored and can be based on both the state of the case and/or the task. Perhaps more importantly, conditions can be based on information that WorkPoint can retrieve referentially. Once the specified condition is detected, then one or more escalation actions are executed. Alert actions can send out predefined mail messages or invoke another process. Of course, it is possible to specify a delay before each action is performed.

For example, it might be necessary to define an alert to send an email, automatically reassign the task, or make an entry in a log file if a specified process instance has not been completed by the time expected. In another situation, the system could be used to monitor inventory levels. If the inventory for an item falls below a certain level, the alert could trigger an email notification and/or create a new process instance to replenish supplies.

### 2.8 Process Optimization and Simulation

WorkPoint offers developers a range of options to check the process. From the Designer, nodes can be completed or skipped. For example, a user can open a process instance and then complete or skip nodes manually to make sure the desired flow occurs. Another approach is to create a copy of the process with all of the early binding options turned on. This causes the WorkPoint Server to evaluate all the transitions, create all of the Work Items and all of the subprocesses when the instance is created. This approach allows users to monitor the path that the instance will take, given the data at the time of instance creation.

Customers typically use WorkPoint’s comprehensive data store to evaluate actual instance metrics against expected instance metrics and make adjustments in the process as necessary. The WorkPoint database schema is completely open and published to allow customers to use enterprise reporting programs to analyze historical data or to extract the data into the user’s modeler application.

### 3 Business Rules

The WorkPoint product suite includes a state-of-the-art Business Rules Engine (BRE) that enables business users with minimum technical skill to graphically create sophisticated business rules. Business rules are invoked to determine whether to follow a conditional transition or as a step in a process. The results of rule executions are stored within the SDS and used throughout the execution of the case.
External applications are invoked by the WorkPoint runtime engine via scripts. The scripting languages used are specific to the version of the runtime engine, either .NET or Java, and can be mixed and matched. The Java runtime engine script object enables the user to invoke SQL calls, any J2EE method, via JavaScript, BeanShell, or an invocation of a Java method or EJB Bean directly in any combination. Thus integration technologies can include, but are not limited to JDBC/ADO/OLEDB, Web Services (SOA, SOAP, XML), J2EE local and home interfaces, standard J2EE connectors, Resource Adaptors, J2EE components, EJB Bean to EJB Bean methods, JMS, and RMI calls. In the Microsoft version, the core product includes both .NET and COM object APIs for integration with C#, J#, VC++, VB, ASP, .NET framework components, VB.Net, ASP.NET, and Web Services (SOAP, XML).

Scripts may be executed either synchronously or asynchronously. Synchronous scripts are managed inside of the transaction state change of the instance or individual task. If the script fails, so does the state change and the work is rolled back. On the other hand, asynchronous scripts are run outside the transaction context, with the work carrying on regardless.

When embedding WorkPoint within other applications, a number of options are available. The functionality of the entire product set is accessible via API calls or Web Services. The core product includes both a stateless Server-API and a state-full Client API. The latter is ideal for integration with client applications. The client SDK includes generic GUI components for process modeling, as well as instance management that can be dropped directly into external applications, enabling the seamless integration of custom or commercial applications with WorkPoint services. The integration interfaces also allow other server-based applications to use the WorkPoint services; therefore, a combined service set is possible.

5 Organizational Structure

WorkPoint integrates directly with whatever human resource data store is in place, whether based on Lightweight Directory Access Protocol (LDAP), active directory, or a third-party product. Rather than
duplicating this information in the middleware layer, WorkPoint, by default, directly re-uses the existing data store. If needed, internally in the product, a human resource data store is provided. Data stores can include email applications, directory services, human resource databases or an external application. The WorkPoint resource object is used to resolve the correct resource for a task. WorkPoint (Java version) can optionally be configured to perform user authentication, using Java Authentication and Authorization Service (JAAS) and Java Cryptography Extension (JCE).

In the .NET version of WorkPoint, authentication is also highly configurable and extensible. Among the standard types of authentication providers included are a password provider, with password encryption between the client and server and hashed password storage in a database, as well as a low security anonymous provider. The anonymous provider accepts the user ID that it is given without any verification, so no password is required. If an authentication scheme that WorkPoint does not implement is desired, then a custom authentication provider can be implemented. WorkPoint requires no code changes – the custom authentication provider is an external assembly that is configured into the system on the fly. This is also true for custom profile and role providers.

6 Process Adaptability

WorkPoint provides a forward looking process architecture that supports dynamic binding of processes as objects at runtime. As each new case of work is created (instantiated), a copy of the source process definition is made to support that case throughout its life. As a result, suitably authorized users can adapt that individual process instance to support the needs of the work at hand. This might involve either reassigning work to specific individuals or roles, or adding new steps/subprocesses, or just changing the routing or dynamically changing the running process instance effecting future tasks in the current instance. This approach eases process design as developers can rely on the ability to change the case if needed to handle unforeseen exceptions.

7 Process Lifecycle

All of the entities in WorkPoint can be assigned to a category, allowing users to filter the information, scripts, objects, etc., providing the firm with an effective mechanism to manage the development effort across a large installation. Process instances with different profiles can move through processes differently as business rules and enterprise metadata dictate. This allows the business to remain in control without sacrificing adaptability.

The WorkPoint archive utility supports export and import of any granularity of object from and into the WorkPoint knowledge base in an XML format. Because XML is used, any process object may be exported from one WorkPoint knowledge base instance into another, regardless of the underlying database used. This is very useful for companies that use different databases in development, quality assurance (QA), and production, or for OEM customers whose clients run different databases.

8 Monitoring, Measurement, and Management Information

As previously noted, the WorkPoint Designer acts as both a design time modeling environment and a runtime monitoring environment. Animated maps of process instances change colors as states of nodes on the map change. Managers can then drill down into the WorkPoint historical information to determine who did what, when, and how long it took.

ACI Worldwide recently added more management reports to the Web-based management console for process monitoring. The reports and dashboard-style feature provides a tabular or graphical display of the status of the work. Data segments within the charts are navigable to explore the underlying data. Standard reports are also accessible via the dashboard component. The management console can also display real-time information and statistics on the WorkPoint engine and associated monitors.
9 Templates and Frameworks

The ACI Automated Case Management System™ (ACM) is a solution built on top of WorkPoint to support fraud detection and resolution across different departments, internal groups, and external entities. The ACM offers users a more general framework to define processes for researching and resolving cases, including investigation, resources, timeframes, escalation paths, and alerts.

WorkPoint takes advantage of third-party modelers’ templates currently enhanced by the enterprise. The templates are a starting point for the enterprise and once processes are optimized they can be imported into WorkPoint. This helps eliminate the need to recreate the process model in the BPM solution.

10 Vendor

ACI Worldwide is a US $300 million software and services company. ACI provides scalable infrastructure software and services that facilitate communication, data movement, systems monitoring, transaction processing, Web enablement, Web security, Web services, and workflow/business process management across heterogeneous computing systems. ACI customers come from all segments of the financial, retail and networking industries, including some of the world's top banks and 25 of the top 100 U.S. retailers.

ACI’s global services organization offers various training and services options that include integration, application development, consulting, and account and project management. ACI also provides support 24/7 through a network of offices worldwide. Outside of the US, ACI has major offices in the UK, Germany, Australia, Singapore, Brazil, and Mexico with an internal presence in over 70 countries.

11 Cost

End-user pricing for WorkPoint is based on a concurrent client user-scaling model. Client users are defined as automated or human users, completing a work item in the WorkPoint application. Entry level pricing is US $20,000, scaling to over US $500,000. An 18 percent annual maintenance fee entitles users to 24/7 support, and includes product enhancements and upgrades.

OEM pricing is based on two components. The WorkPoint development license offers ISV’s the software platform necessary to integrate WorkPoint with their application, and provides support services for runtime licenses after distribution. The second component, WorkPoint runtime licenses, authorizes an ISV to distribute WorkPoint as an embedded component of their application. WorkPoint runtime licenses are purchased in bundles with a sliding license fee scale, with payment being made when licenses are distributed. A 15 percent annual maintenance fee entitles the ISV to 24/7 support, and includes product enhancements and upgrades.
1 Product Overview

Appian Enterprise aims to provide an integrated platform supporting all of a firm's needs for process enabled applications focused on people and the systems/data that they interact with. Effectively, Appian Enterprise provides a web-based, process-enabled workspace that can support both highly structured processes and evolving collaborative projects amongst knowledge workers. It leverages executable process models and business rules through a variety of collaboration tools, content and knowledge management capabilities, sophisticated integration tools, and a highly secure identity framework and organizational model.

All of this is delivered through an integrated portal environment that is designed to help capture and manage change in its original context, rather than necessarily forcing a rigid control ethic on process. The product provides an ad hoc environment that supports users as they discuss, collaborate, and evolve their response to inevitable exceptions, helping them to categorize and track them, evolving their process structures accordingly.

To achieve this, Appian Enterprise presents a suite of tools that balance the need for control with the capability to evolve and adapt processes. Overall, the environment is designed to make applications simple to deploy, or to have multiple variants of an application that may be deployed to different environments, for different purposes, at the same time.

Under the covers, it features a standards-based, services-oriented architecture that integrates with third party tools, as needed, and scales to support even the largest enterprises (Appian's biggest customer is the US Army with 1.5 million users and 500,000 logins per day). To appeal to such customers, the product incorporates a rule-driven security and identity management layer that administers access controls and role-based permissions, preventing end users from participating in processes in undesired ways. The architecture also includes a secure document management environment, as well as personalized dashboard-style process analytics based on real-time and historical reporting.

2 BPM Engine

Appian Enterprise is a 100% web-based J2EE solution that supports emerging process modeling standards such as BPMN, as well as a wide range of Web Services standards, including SOAP, UDDI, WSDL, and XML. The power of Appian Enterprise 4 can also be incorporated into existing portal applications through JSR-168 portlets.

The product consists of a number of replicable engines at the back-end that communicate with the Java interface layer to support the portal presentation layer. State information and information on associated objects such as attachments, assignments, and pages are persisted in the data store. In this way, Appian Enterprise can simultaneously manage multiple instances of a single process definition and ensure that all process data are available for historical reporting and review.
The back-end environment also implements its own independent fail-over and load balancing capabilities. This provides greater control over the way in which functionality can be distributed across technology infrastructure and how it may be scaled to support the needs of the firm.

Appian Process Modeler provides business users with a web-based environment to create, share, and reuse process objects. It is based on a DHTML drag-and-drop interface accessing a secure library of templates, services, and business rules.

Appian Process Controller is a management tool for starting and stopping processes, rolling back changes, and modifying process and rule definitions (i.e., changing processes in-flight).

Appian Process Engine is the core process execution environment. It utilizes high performance, in-memory technology, to support high volume throughput. Execution Engines can be replicated.

Appian Rules Engine provides a central rules management capability accessible across all other modules. (See Business Rules.)

Appian Process Portal is a process-centric portal framework that provides users with a centralized web-based resource for information access and collaboration. (See User Interface)

Appian Document Manager provides a secure storage mechanism for electronic documents, images, and other files supporting version control, check-in/check-out, and tightly integrated reporting capabilities. It features a delegated security model with community, role, and individual based access controls at the folder and individual document levels. All objects are stored with configurable metadata, which can be modified on the fly as part of a process.

Appian Collaboration provides a number of teamwork mechanisms to facilitate the identification of suitable experts, with sharing information in real-time, including white pages, group directories, an ask-the-expert feature, discussion forums, decision forums, polls, surveys, and group calendars. They integrate with third party collaboration tools such as instant messaging/chat, email, whiteboards, online meetings, etc. These collaborative virtual workspaces allow workgroups to coordinate their efforts and exchange information regardless of organizational and geographical boundaries. They incorporate user-defined subscription capabilities and delegated administration that enable non-technical users to set up and configure collaboration workspaces.
Appian Personalization delivers a secure, web-based framework for managing preferences, attributes, and relationships between people and information, creating ad-hoc and rule-based groups on-the-fly, and securing content based on user attributes or group membership. This security framework operates as a consistent management layer throughout all Appian Enterprise modules.

Appian Analytics provides visibility into enterprise performance for executives, managers, and analysts. It features secure, web-based reporting dashboards with performance metrics, status channels, exception notifications, and process audit trails.

Web Services can be used to consume, expose, and orchestrate business processes. A step-by-step wizard in the Process Modeler supports the creation of Web Service-based Smart Nodes that can then be re-used in any process model. Web Services can also be used to support integration through a library of pre-integrated application adapters. (Appian now bundles the iWay adapter set to access third-party enterprise applications such as SAP and PeopleSoft.)

2.1 Platforms

Appian Enterprise 4.0 is completely vendor, technology, and platform neutral. The product uses J2EE technologies to support its 100% web-based approach, which is designed to minimize its footprint (e.g., no client install for the Process Designer). Moreover, it is deployable in both J2EE and Microsoft-centric environments and has been certified to run on all major platforms including Solaris, Linux, and Windows. It is compatible with all major database environments including Oracle, DB2, MySQL, and SQL Server.

Additionally, Appian Enterprise can run on any J2EE-compliant application server and has been certified on JBoss, WebSphere, WebLogic, Jakarta Tomcat, and Oracle. To facilitate deployment in organizations without enterprise application server licenses, Appian Enterprise ships out-of-the-box with JBoss. Appian Enterprise’s runtime browser-based environment is certified with all of the latest browser versions, including Netscape 7.1+, Mozilla 1.7+, and Internet Explorer 5.5+.

2.2 User Interface

Appian Portal is a web-based desktop that provides users with a single point of personalized access to enterprise applications, information, and data sources from within and outside the organization. Appian Portal includes an embedded ‘Work Portal’ where users manage their daily activities.

Figure 2. The Appian Portal environment provides a personalized Inbox that acts as an entry point to collaboration workspaces
The Work Portal provides users with an MS Outlook-like task Inbox interface. Channels within the portal framework may be personalized to meet the specific needs of individual users and groups alike. The task list has a preview pane at the bottom, along with any capabilities provided to that user to re-assign or edit the way in which the process operates. The left-hand column provides links to different areas of functionality, reporting, micro-portals (for different departments and teams), management portals, personalized views for all users, etc. On the right-hand side, is a meta-data driven area for content that is associated with the task. This could include anything – a note, web site, another application, instructions on how to get help, links to people, links to IM and collaboration interfaces, etc. Personalization options made available to the user include the ability to share, change, edit, add portlets or channels, etc. If the user has appropriate authorization, he or she may change the permissions on the workspace, add new participants, etc.

The portal also includes links to the process workspace where all the related information is gathered and presented (access controlled by the security framework). Here the user can see the people involved and browse related documents or discussions that have taken place. Of course, the user does not have to come to the workspace directly; as they work; the relevant information and status changes are added to the workspace.

The portal framework contains a Notifications service that sends both alerts and tasks from the system to end users. By default, users receive these messages in their Inbox. However, users can build personal rules, potentially relaying notifications to email, wireless devices, and other communication channels at user-specified intervals. The portal acts as a personalized gateway to applications, information, and data sources.

Control and design of this environment is part of the modeling environment. Any action, whether it is creating a new discussion thread, adding a document, or adding a person to a new distribution group is supported out-of-the-box through Smart Nodes. (See Processing Modeling below.)

### 2.3 Scalability

Appian Enterprise powers sites support over 1.5 million users and over 500,000 logins per day. The product set is architecturally designed to maximize flexibility and scalability while minimizing its footprint.

The architecture follows a component-based paradigm, allowing portions to be modified or optimized, based on estimated throughput. For instance, static portions of content (HTML, images) can be stored on servers optimized for serving static content, and more dynamic view-layer pieces can be stored on J2EE application servers. The architecture also allows distributed deployment and high availability through clustering. To prevent single points of failure and bottlenecks, the web servers, application servers, and database servers can be clustered and load balanced to improve performance and availability.

## 3 Processing Modeling

Appian Process Modeler is a web-based, end-user oriented, process modeling tool that is used to design, edit, and publish executable processes. With appropriate permissions, users may edit both the generic process models (for new cases or all running cases) and the model underpinning a specific instance. The environment provides a number of different modeling palettes from which users drag-and-drop nodes, linking them together to create the desired process without coding or programming.

The overall modeling environment is based on the BPMN specification with standard Activity nodes (Tasks), Gateways, Events, and Notifications. The current version does not include BPMN modeling support for Compensating Transactions, although we understand that this will be available in version 4.1 (due beginning of Q2). The semantics support looping, multiple instances, subprocesses, linked
processes, and exceptions. Organizations can override default values with their own process notation, if they choose.

Supplementing the standard BPMN concepts is an extensive set of Appian Smart Nodes arranged on various palettes. Smart Nodes are process nodes that facilitate interaction with other Appian Enterprise functionalities. Smart Nodes are divided into four sections – Collaboration, Content Management, Users & Groups, and Integration. The Integration Nodes provided include nodes that enable Web Services-based integration with other systems and interaction with databases. These integration nodes are extensible through the Eclipse-based Java development environment. (See Integration on page 56.) The security framework governs the display of the palettes, and the nodes displayed on them.

All nodes have a complete set of configurable properties that enable designers to define assignment, escalation criteria, data flow, variable mappings, and attach notes or documents. Processes can use Smart Nodes to kick-off message board discussions, create/update documents, launch/modify portal pages, etc.

The engine supports the ability to run multiple instances of all nodes. This is controlled in the process model and, depending on the need, can be configured in a variety of ways. It could be based on an exact number, an expression, on some variable (e.g., one instance for each member of an array).

In conjunction with Smart Nodes, the Expression Editor allows designers to customize the behavior and logic of a given process or data. It is designed to assemble complex expressions using simple point and click methods, accessing all the relevant functionalities provided by the object model of Appian Enterprise. (For more on the Expression Editor, see Business Rules.) The Expression Editor can also be used for complex work assignment rules (e.g., to find the manager of the employee at the last step).

Process models can be saved at any time, in any state, so that users can reopen a process draft and continue work. A user may choose to validate a process that will then list all errors or process exceptions at the bottom of the Modeler interface. Users can also run simulations on saved processes, using real, historical data, and Appian Analytics to identify potential bottlenecks and improve processes before deployment and execution. Once a draft is complete, vetted, and tested, users may publish processes directly in the designer interface, making them available to users through the web-based process execution interface. The resulting process model is stored in XML.
3.1 Subprocesses

Appian Enterprise supports reusable, object-oriented subprocesses. Dragging and dropping the Subprocess Node onto the Process Modeler canvas, users then select and incorporate these subordinate processes into larger scale models, assign data mappings to pass values between parent and subprocesses, and assign escalation criteria.

The product supports arrays, or multi-valued variables, that help modelers aggregate and manipulate data from multiple subprocess instances. Further functionality is provided to allow the modeler to control how long the parent process is going to wait for a response from the child. The system could be set to move on as soon as one of the children has finished; when all children have completed; or when even more complex n out of m scenarios (based on an expression) occur. Moreover, the modeler has control over whether these subprocesses (or nodes) are run in parallel or in sequence (takes the output from one to the input of the next).

Appian Enterprise also supports reusable Linked processes, which are independent, asynchronous processes launched by a parent process. Unlike subprocesses, linked processes typically do not return data to the parent process and do not interrupt the flow of a parent process.

Using the multiple instance functionality of the engine, designers can design process architectures where multiple subprocesses are triggered, assigning one to each member of an array (any collection of objects). Combining this functionality with the Linked process concept, the system could spawn a new process for each customer in a database.

3.2 Shared Data Space

Within Appian Enterprise, the SDS is the Process Workspace. It stores the contextual information of the process instance. Its structuring includes all the process variables and attachments. Appian allows the developer to import any existing forms (HTML, JSP, PDF, and InfoPath) and map them to the developer’s process variables.

Along with the expected variable types (text, number, string, etc.), there is the whole range of Appian object types, all of which are natively supported within the Process Workspace (documents, folder, form group, collaboration community, knowledge center, etc.) Any of these can then be set to an array, allowing the modeler to do all kinds of manipulations and operations – aggregate them, investigate them, select into them, launch processes based upon them, etc. For example, it would then be possible to find all the members who have taken part in a discussion, or to find the editors of a document.

Appian Collaboration, a scalable, secure, intuitive document management tool, is a key component of the Appian Enterprise suite. Documents central to active processes, added as attachments, or uploaded for use as process forms, are all stored in the Appian Document Manager. Designers may configure Smart Nodes to manipulate documents as a process progresses, even using processes to vet and modify mission-critical documents, to create new document folders and assign associated security, or to initiate threaded discussions linked to stored documents. The Appian Document Manager supports document versioning, check-in / check-out functionality, complete auditing of all document activity, including document read history and distributed document administration. Like Appian Process, the Document Manager is governed by Appian’s advanced, scalable group-based security model, enabling rule- and role-based protection of sensitive content.

3.3 Forms

Process nodes that gather user input provide process designers with default data forms and enable them to customize the interface if necessary. Designers manipulate forms directly through the Process Modeler by adding/removing questions, response input fields, and process variable mappings.
Users may also choose to upload forms directly into the process or link to existing forms stored in the Appian Document Manager (HTML, JSP, PDF and InfoPath).

### 3.4 Time

Process designers may manage time at the node or process level. Designers can dictate time-based escalation criteria at each node within a process, executing escalation instructions based on the amount of time that particular tasks take to complete or based on process-wide time metrics (supported by process variables).

Designers can use the escalation framework to send alerts or notifications to process actors, notifying them that a particular task is about to be escalated and reassigned, or that the overall process is about to fall behind schedule. Designers may also manage the schedule of individual nodes by entering a specific execution date/time or establishing a recurring execution schedule at specified time intervals.

### 3.5 Process Optimization and Simulation

The core engine provides a discrete event simulation capability that uses the actual process model itself, reflecting subprocesses, integrated arrays, and historical data where relevant. The simulation exports automatically to Excel.

This feature is usually deployed by process designers who simulate their prototype models before publishing them to reduce potential bottlenecks and to gather other information to underpin process optimization.

### 4 Business Rules

Appian Enterprise incorporates its own Rules Engine. This engine facilitates user group creation, document management permissions and message board access throughout the product suite. It also helps designers manage flow through a process, control or distribute administrative access to process models, or govern escalation procedures.

![Expression Editor](image)

Figure 4. The Expression Editor provides the main interface to the business rules engine, facilitating both script development and access to advanced functionality related to Appian objects.

The Expression Editor is the main interface to the Rules Engine. It provides an extensible interface for rule creation based on process variables, form fields, and a range of Excel-like functions. The Expression Editor can be used to define completion criteria for a set of work items (e.g., that 3 of 5
managers must approve), the rules by which a process diverges down multiple paths, or it can be used simply to transform user input into formats needed later in the process. To handle even more sophisticated rule collisions and rule tracing, Appian Enterprise 4.0 integrates with third party Business Rules Engines (BRE’s).

5 Integration

Appian Enterprise 4.0 implements a component-based, service-oriented approach to process integration through Appian Business Connect. Appian Business Connect allows organizations to incorporate enterprise sources of data, documents, web content, reports, and identities within the framework of its services-oriented architecture.

Appian Business Connect ships with a pre-integrated library of application adapters for retrieving and transforming data from third-party enterprise applications. These adapters use public APIs, standards like Java Connector Architecture (JCA) and Web Services to expose third-party application logic to the Process Modeler and the Process Engine. Once retrieved, enterprise data can be used within the Expression Editor to define rules that govern flow, transformation, and assignment, or can be exposed to end users using Appian Forms.

For example, the Oracle Node allows the designer to get at all the content in an SQL database. It generates the SQL based on a lookup to column names. Of course, this sort of functionality is designed for IT developers (rather than end-users). Developers can also inspect the WSDL of a Web Service and map that back to the variables in the SDS using a step-by-step wizard in the Process Modeler.

The product provides the ability to create and register new Smart Nodes as reusable components that define an action like retrieving enterprise data through a published API or initiating a Web Service. Once a Smart Node is created, it is represented as a unique icon on one of the palettes of the Process Modeler.

In addition to supporting Web Services integration, Appian Enterprise also ships with an Application Programming Interface (API) and a full library of Appian Services. Appian Enterprise contains pre-built adapters to major third-party software integration companies to facilitate consolidation of enterprise resources into one user interface and increase deployment speed.

6 Organizational Structure

Every user in Appian Enterprise belongs to one or more Groups. Groups usually equate to roles. Permissions to access different areas of the application are granted to either an individual user or to a group to which a user belongs. Users are explicitly added to groups, or can be assigned membership to a group based on rules. These group-oriented rules can filter the user community based on their attributes, allowing access only to those members matching certain criteria.

There are three different types of security settings for groups in Appian: personal, restricted, and public. Public groups can only be created by system administrators and are, therefore, generally beyond the scope of process designers. Personal and team groups are used most widely within a process. Members of a group with personal security settings cannot see the other group members on their list; in a restricted group, they can.

The approach taken provides a dynamic ability to control users’ capabilities based on their role (membership of a group), which may be only a temporary thing. User permissions are assigned not only by task and role, but also by business rules. This allows the system to build dynamically a temporary group and then apply rule-based permissions to that group. For instance, it would be possible to create a temporary group of all users logged in on a Monday morning and then ensure that they can only see a subset of the available task in their Inbox.
Out-of-the-box, the system comes with a number of generic roles that can be used in assignment settings of tasks (process initiator, designer, coordinator, etc.). These generic roles are extensible, for example, to include auditor or process owner.

The product integrates seamlessly with Identity Management Systems like LDAP and Active Directory or with common single sign-on technologies like Netegrity Siteminder.

7 Process Adaptability

It is in the area of adaptability that Appian really seems to excel. Not only does the product support the ability to re-assign tasks, but it also supports fine grained control for changing the underlying process for a single case of work without pausing or canceling the existing case.

Using all the functionality of the Process Modeler, task recipients may reassign or escalate assignments directly through their task inboxes. Suitably authorized end users can make changes through to the way a generic process model or a specific process instance will execute.

In the process execution environment, suitably authorized users access a toolbar featuring options for managing, monitoring, and making changes to the current process instance. Through this interface, users might stop or pause the case, to be resumed later. The Edit Process option opens the current case in the process modeler environment, displaying the progress of the current process instance and allowing the user to make changes.

For example, a manager viewing Appian’s real-time analytics interface may identify a bottleneck at a particular step or associated with a particular business rule or user. The ability to make in-flight changes allows him or her to instantly address the problem, reassigning the task, or to reroute the paths of future processes to ensure that tasks are completed successfully. In a collaborative project environment, this functionality could support knowledge workers as they add new process fragments to the parent to facilitate changes that may occur after the project begins.

8 Process Lifecycle

By default, modifications published over the top of previously published processes are saved as a new process version. Users may also save a new version of the process at any time by selecting New Version from the File Menu. Every executed process instance is mapped to the specific process model version that was used, enabling an already running process to execute to completion based on its initial setting.

If a generic process model that is currently running is edited and saved, then any existing cases will continue executing using the old process model version; any new cases initiated after the modifications to the process model will use the new nodes and settings in the model.

Using the product itself, users could design a process that supports the lifecycle of the process, enabling the firm to link associated documents and discussion/collaboration threads that occurred during development, including lifecycle approvals, releases, changes, etc. Although this functionality is not delivered out-of-the-box today, it is scheduled for an upcoming release.

9 Monitoring, Measurement, and Management Information

The Process Engine stores all process data and process states in order to support detailed analytics for managing personnel productivity, process performance, bottleneck identification, and resource management. The Process Engine maintains a history of every event (e.g., reassignment, escalation, notification) that occurs in a process, and the audit data can be viewed for any running or completed process.
In addition to availability though the administrative interfaces, the audit trail is accessible to users from within Task Details and the Process Details page in the Process Portal. This allows users who are responsible for completing the next step in a process to have additional information on the task in question, its deadline, and where it fits within the overall process lifecycle. (See Figure 5.)

The Process Analyzer provides graphical and grid-based reports based on the underlying process data. The Process Analyzer supports web-based Dashboards that are available to participants responsible for tracking the performance of a set of processes. Alternatively, they can be made available to all process participants.

The Process Analyzer provides real-time status information based on a discrete set of performance metrics. Some metrics available include the lag time (how long the task sat in a queue), task time (the amount of time a human has been working on the task), and completion time (the total time the task took to complete), and how these values compare to historical values for process instances of the same process model version.

These Dashboard style reports incorporate Key Performance Indicators (KPI) that can be monitored by process owners or system administrators to identify process and performance bottlenecks in real-time.

The Process Analyzer also supports the ability to do more thorough analysis on process data, using OLAP reporting tools like Crystal Reports, MicroStrategy, and MS Excel. The Process Analyzer exports process data, including all process variables, into a relational schema that these tools connect to using ODBC.

In addition to providing standard reports to help organizations identify bottlenecks, distribute tasks, and improve processes, Appian Enterprise allows users to create and save customized dashboards, enabling personalized visibility into their different business areas.

10 Templates and Frameworks

Appian Enterprise ships with a set of industry-specific process modules. These modules contain pre-built models demonstrating common processes in Government/Defense, Financial Services, Health Care, Insurance, Retail, etc. These process drafts help users master Process Modeler functionality quickly by serving as process examples. Additionally, they are used to reduce development time by providing starting points for more complex client-specific process models.
11 Vendor

Appian was founded in 1999 and is entirely self-funded (no VC backing), being profitable since its first day. Since its foundation, Appian has maintained consistent growth on all fronts – employee base, customer base, and revenues. Appian currently has 165 employees and has experienced revenue growth of over 700% between 2000 and 2003. Appian’s 2003 revenues were $23 million. The company has more than 100 customers, and there are currently more than 6.5 million seats of Appian Enterprise software deployed. Software comprises about 35-40% of Appian’s revenues; services represent 55-60%. Appian distributes Appian Enterprise mainly in the US, and all sales offices are currently in North America.

12 Cost

Appian Enterprise is priced and licensed on a named user basis. Pricing per named user starts at $1,000 per user and decreases incrementally as the number of users increases. Quick start pricing is available at $50,000 and includes some professional services/customization, if needed. Typical projects start at $100,000.
1 Product Overview

The Ascentn AgilePoint was designed to enable organizations to deliver BPM objectives with the philosophy of *Think Big, Start Small*, and *Scale Fast*. Ascentn believes this is the most practical way to practice BPM and create managed success in view of the challenges faced with technology, people and culture adaptation.

From the ground up, AgilePoint leverages the entire Microsoft product set and environment (.NET, Visio, InfoPath, SharePoint, ASP.NET, Exchange, Windows Workflow Foundation, Office System, OpenXML, SQL Server, BizTalk, and Visual Studio, etc.) to deliver a robust and scalable BPM Engine, which, through reuse of process assets, supports both human workflow and automated processes and enables business managers to leverage the stack of Microsoft products and technologies as simply as diagramming a process model. The product extends Visio into a full lifecycle BPM productivity tool, from design into production, and through iterative improvement. It allows business managers to model and execute business processes straight from Visio, free of rigid code generation that limits run-time adaptability, to deliver a high degree of in-flight process adaptability and hence business agility.

Figure 1. AgilePoint extends Visio into a full lifecycle BPM productivity tool.
AgilePoint is entirely .NET based; aiming to deliver a platform that is 5 to 10 times more cost effective than J2EE-based BPM Suites, thus extending affordability to mid-size and small businesses. Although based on .NET, AgilePoint employs a lot of J2EE type functionality with highly scalable discrete components reflecting the past experience Ascentn's key designers have had with J2EE. The result is a highly scaleable n-tier process architecture that allows firms to easily abstract process logic from underlying application codes and enables business managers to change and control business processes directly.

Through its tight integration of Visio, AgilePoint can provide end-users with an accessible environment, allowing them to re-use existing process descriptions by adapting them for the AgilePoint environment. Through the integration with Visual Studio, AgilePoint lets IT control the infrastructure, leverage existing Microsoft assets and skill sets, and expose custom and SOA developments in abstracted, easy-to-understand process descriptions. Through its tight integration of Visio, the product provides business managers a familiar and accessible environment and lets them control business processes through re-using existing process descriptions to create or improve directly executable workflows, end-to-end business automations and SOA applications, creating effectively an actionable process layer.

Under the covers, and conforming to WfMC XPDL, AgilePoint is standards-based via its engrained XML support. XML-based process descriptions are fully translatable into emerging standards such as BPEL (once it clarifies). At runtime, the BPM Engine directly consumes XML process models and performs dynamic binding of process fragments via its Web Services functionality, enabling highly adaptable process architectures.

Figure 2. AgilePoint delivers tight integration with Microsoft Office 2007.
AgilePoint delivers tight integration with Office System 2007 suite. For example, for InfoPath and SharePoint, AgilePoint directly reuses functionality delivered in these environments. For instance, basing a process model in InfoPath allows the model to inherit its underlying data structure and any pre-defined views. With regard to SharePoint, AgilePoint provides integration with document libraries, form libraries, lists, etc. The integration allows business managers to create sophisticated business processes graphically in an unrestricted authoring environment based on Visio. This enhances the native facilities provided by SharePoint, extending the native collaboration and document management capabilities to support cross-functional, end-to-end business processes. AgilePoint effectively elevates the business user empowerment goal of SharePoint to a new level that lets enterprises leverage SharePoint as a highly adaptive ‘hub’ for their end-to-end business operations.

In addition, AgilePoint also integrates tightly with Microsoft BizTalk for robust back-end information flow orchestration, integration and transaction capabilities to promote reuse and expedite BizTalk-enabled application deployment. BizTalk orchestrations and business rules can be abstracted as easy to use process descriptions and directly included into their process models by business managers. As a result, this allows AgilePoint to drive sophisticated BizTalk orchestrations, and leverage its Business Rules Engine to provide a comprehensive enterprise class BPM platform. Other supported Microsoft integrations include Microsoft Dynamic solutions such as Axapta, CRM, etc. AgilePoint also offers a rapid enablement solution to migrate Lotus Notes workflow to .NET.

# 2 BPM Engine

The AgilePoint environment is designed to deliver high performance, yet to be lightweight, allowing deployment in virtually any business operation. The advanced event-driven, object-oriented, plugable and moldable architecture allows domain specific extension for use by third party ISVs and OEMs. This architecture enables customers to directly leverage AgilePoint engine components, reducing development cost and time. The AgilePoint architecture uses Microsoft .NET and Web Services to link together the presentation layer, logic layer (AgilePoint Server) components, and data layer.

AgilePoint presentation layer provides interfaces for the design, development, execution, management, and monitoring of the process and its instances. AgilePoint incorporates the following presentation components (of course, AgilePoint can also be embedded in external applications):

- **AgilePoint Envision** – an extension of Microsoft Visio, enabling process designers to define and simulate their process templates and deploy for execution through the Microsoft Visio interface
- **AgilePoint Developer** – an extension of Microsoft Visual Studio, allowing application developers to leverage AgilePoint’s BPM framework, e.g. AgilePart, and abstract custom developments, Web Services, etc., into reusable process descriptions at the process tier. It also lets firms implement more complex process and application logic to create domain-specific extensions, reusing processes, and other AgilePoint server functionality
- **AgilePoint Enterprise Manager** – a web-based interface for power users or system administrators to manage, monitor, and audit the AgilePoint BPMS and its runtime processes
• **AgilePoint Server Configuration** – a desktop-based configuration tool for the system administrator to configure the various system parameters such as SMTP server, database settings, custom server extensions, etc.

![The AgilePoint Architecture](image)

*Figure 3. The AgilePoint Architecture is built from the ground up on .NET*

The logic layer provides the core functionality of the AgilePoint Server. There are multiple components, each providing its own specific features and functions. These components interact with each other, the presentation, and the data layer. They are invoked either through components in the presentation layer, through the AgilePoint Web Service interface, or through the Server-side API.

The major components are:

- **Process Engine** – provides the core of the AgilePoint Server. It is a WfMC compliance process execution engine using an extended set of XPDL constructs. It consumes XML-based process definitions designed and deployed through Envision. The engine is capable of performing dynamic binding and loading during execution, supporting enhanced flexibility and agility at runtime without incurring engineering cycles.

- **Session Manager** – handles the client application connection session, including security authentication and authorization. This component is also responsible for monitoring the behavior of the activities throughout the process and for keeping track of the audit trail of the process.

- **Request Queue Manager** – manages task requests. It maintains the multi-threaded, asynchronous execution of a series of task requests, which can be prioritized, delegated, reassigned, suspended, resumed, and cancelled. Control over these facilities is either through programmatic...
rules or pre-defined delegation rules, or they can be triggered manually through the Enterprise Manager.

- **Process Template Class Loader** – handles the loading of process models and their execution instructions. For example, the instructions could be a Visual Studio.NET project containing custom code to control the runtime behavior of the process instance. The process template definition and instructions are fed to the Process Engine.

- **Process Swapper** – uses an intelligent algorithm to swap out processes from system memory to maximize the use of system resources and offers high degree of efficiency for managing long running processes.

- **Server Coordinator** – manages the server and system configuration, including database configuration; system administrator settings and authentication mechanisms; and email related settings. In a multi-server deployment scenario, this component also manages the clustering and load balancing relationships and configurations among multiple servers.

- **Escalation Monitor** – keeps track of whether an activity or a process is overdue and triggers appropriate action via the Exception Handling component (which also monitors system-level exceptions). For example, AgilePoint can dynamically invoke a fast-track subprocess, raise priority, or reassign to a different user for an overdue task.

- **Notification Preprocessor and Deliverer** – handles email notifications. These can be based on different states that an Activity may enter.

Figure 4. Extending the capabilities of AgilePoint via the server-side plug-in framework

The core functionality of the AgilePoint Server can be extended through the AgilePoint BPM frameworks—AgilePart, AgileWork, AgileStub, and AgileConnector, etc.—to enable abstracted leverage and manageability of applications and infrastructures at the process tier. All are created with AgilePoint Developer via standard AgilePoint enabled project templates and AgilePoint APIs in Visual Studio.

- **AgilePart** provides the integration mechanism to extend AgilePoint at the “activity” level with external applications, such as ERP, CRM, etc., that is configurable and reusable across process templates and can be used by business managers at the process tier to build directly executable process models. AgilePart functionality can be generic or domain-specific. AgilePart can be directly reused by business managers at the process tier, (i.e. within Visio-based AgilePoint Envision, instead of within a developer’s environment). AgileParts can be individually registered with the AgilePoint Envision modeling environment (in Visio) or centrally managed and downloaded as a group from the AgilePoint Server. AgilePoint provides out-of-the-box AgileParts for the
following applications and technologies: SharePoint, InfoPath, SQL, Web Service, Exchange, Office System OpenXML, and Windows Workflow Foundation, etc.

- **AgileWork** provides the integration mechanisms to extend AgilePoint at the ‘activity’ level with reusable, configurable meta-data-driven dynamic manual activities that are shareable across process templates.

- **AgileStub** provides the ability to associate external functionality that is intended for a specific process template.

- **AgileConnector** provides users with a way to extend the core functionality of AgilePoint Server or to control various aspects of its runtime behavior. Examples include custom exception handler, custom load balancing, message queues, etc.

Once an AgilePoint process model is deployed to the AgilePoint Server, the Server will instantiate the process model in response to user requests (through the user interface of an AgilePoint enabled application), an event, or programmatically. The AgilePoint Server then executes the process instance based on the definition, while maintaining status information in the database. This control data is used in process management, monitoring, and reporting.

Web Services can be used to call subprocesses (and publish process descriptions). They are also used within AgileParts to integrate external functionality.

### 2.1 Platforms

AgilePoint server runs on Microsoft Windows 2003 Server and the coming Windows Vista Server. Supported databases are, respectively, SQL Server 2005 and Oracle databases through ADO.NET, and Oracle Data Provider for .NET. This architecture can be easily extended to support other data sources, if needed.

### 2.2 User Interface

![Figure 5. The MyTasks list is delivered in a web browser](image-url)
AgilePoint application interfaces provide capabilities for users to perform their manual activities and also to manage, monitor, and audit the processes. Users can access and perform their assigned tasks through a variety of interfaces including Outlook Tasks via Exchange Server integration, AgilePoint Enterprise Manager, or embeddable in-application interfaces such as Task Management Webpart for SharePoint, Task Management Control for ASP.NET, etc. Through AgilePoint Enterprise Manager, users have access to a browser-based environment and are presented with a holistic view of all the tasks assigned to them and/or any issues awaiting resolution across all areas. Drilling down into MyTasks takes the user to a list oriented view. A task could be assigned directly to a specific user, or it could be placed in a shared queue that is accessible to all members of a given role or group. Tasks in the queue can be prioritized. Further, AgilePoint is also capable of supporting dynamic, multi-level, parallel process voting.

**Figure 6.** The AgilePoint task management user interface as a SharePoint Web Part

AgilePoint also provides task management interfaces that can be easily incorporated into an AgilePoint enabled application. These interfaces include task list, task status, process viewer, etc., and are included automatically when creating an AgilePoint Web or server application in AgilePoint Developer. Of course, the look-and-feel of these interfaces can be further modified to meet custom needs. AgilePoint also provides a task management Web Part for the SharePoint Server that shows only tasks related to SharePoint-based business processes.

### 2.3 Scalability

AgilePoint has adopted a highly scalable 3-tier architecture, which can scale to n-tier. The decomposable architecture allows AgilePoint’s various components to be deployed into a single server or across multiple servers. AgilePoint supports both local and remote database servers and can share the same database server with other applications.

Through NLB and clustering, AgilePoint provides overall *scale-up* scalability. In addition, AgilePoint also provides application context driven *scale-out* scalability by allowing process fragments and AgileParts to be executed on their own dedicated or clustered server, reducing the load on the main AgilePoint Server environment to ensure predictable process management performance. The *scale-out* scalability is accomplished by deploying a custom load balancing AgileConnector to the AgilePoint Server.

**Figure 7.** AgilePoint can be distributed and incorporate additional process engines
AgilePoint provides fail-over support by switching to a hot standby back-up server automatically or manually. Automated switching could be accomplished by third party hardware enabled solutions such as Heartbeat or through Microsoft Windows Server fail-over support. When manually switched, all that is involved is the pre-replication of the AgilePoint Server Config file.

3 Processing Modeling

Process models are defined by designers using Microsoft Visio-based AgilePoint Envision. Using the Envision extension for Microsoft Visio, users drag and drop Visio shapes (i.e., reusable IT assets in the form of process descriptions such as AgilePart, AgileWork, etc.) from the AgilePoint stencil onto the canvas and link them together. Alternatively, users can take an existing Visio model and adapt it for use within AgilePoint.

Either way, this approach allows users to quickly put a process model together. Process models may be saved in a Visio file format to facilitate sharing and collaboration throughout the design process. Once developed, the model is saved in an XML format (based on an extended version of XPDL), and then deployed directly to the AgilePoint Server for execution.

More sophisticated AgilePoint enabled applications are built using the AgilePoint Developer application within Microsoft Visual Studio. This allows the developer to associate custom code with the process template, using an AgileStub. Moreover, developers can build libraries of AgileParts of pre-integrated Tasks and libraries of AgileWorks of dynamic manual activities that can adapt behaviors at runtime, according to meta data, placing them on a Visio Stencil to make them available to process modelers and business managers. As a result, the business analyst can reuse functionality established by the specialist IT developer, effectively enabling the business to leverage its existing IT assets.

The AgilePart and AgileWork functionality is very powerful. For example, each AgilePart can call specific functionality in an external application, yet provide it in a way that business analysts and users can deal with. For instance, AgileParts might be built as a generic Web Service call that, at runtime, prompts the user for the sort of service required. Web Services-based AgileParts provide an SOA (Service Oriented Architecture) development environment that enables the rapid creation of loosely coupled applications.

![SharePoint Server extended stencils](image)

Figure 8. The AgilePoint modeling environment leverages Microsoft Visio; this example shows the SharePoint Server extended stencils.
Activities can trigger different email templates at different stages. Email templates contain dynamic runtime data such as the activity's participant information or the unique process instance name.

3.1 Subprocesses

In effect, all subprocesses stand alone and are called dynamically at runtime. Any process model created in AgilePoint Envision can be loaded as a subprocess through the Subprocess activity. Both Web Services and native APIs are used as the mechanism to call subprocesses. Nested calls are supported.

The precise subprocess to use is either identified directly at design time, or determined at runtime via a process variable – in which case, the name of the subprocess is preceded by a $ (SubProcess_Name). As a result, the subprocess could be determined by a Web Service call (performed by an AgilePart), a business rule, etc. Once a subprocess is called, an instance of the subprocess is created, allowing the developer to customize the subprocess instance programmatically at runtime for use within the parent process, without affecting the original subprocess template.

3.2 Shared Data Space

AgilePoint's Custom Attributes mechanism provides process and application related data management within a process instance or across multiple process instances. This data is used by the AgilePoint to perform specific data driven business logic, such as decision-making and conditional branching. Users can import or construct process and application related data through the Custom Process Property windows in the Envision component. Internally, AgilePoint uses an XML schema to capture and represent custom attributes.

When used with InfoPath, AgilePoint directly inherits the XML schema of the InfoPath form. The same capability is extended for Microsoft Office 2007 through OpenXML support. The process modeler merely creates the new process based on that form, immediately inheriting all the structure and definition therein. Individual fields are then available for use within the Activities of the model, such as the multi-condition business rule activity to drive process logic. Moreover, when used with InfoPath, the different views are also available to bind to the different Activities. When uploaded to the AgilePoint Server, the modeler can select to upload the form to SharePoint, and AgilePoint will automatically create the forms library if it does not already exist.

Custom Attributes can also store information relevant to a process instance, such as uploaded electronic documents, scanned images, or any other digital content. This information could be stored in an external database or content management system, etc. A unique identifier is stored with the AgilePoint process instance construct to facilitate retrieval.

3.3 Forms

AgilePoint advocates Microsoft-based forms technologies such as InfoPath, ASP.NET, WinForms, Excel forms, etc. As discussed above, it enables the firms to directly incorporate InfoPath forms into their processes and leverage InfoPath XML data schema.

Through AgilePoint process-aware Web Controls, AgilePoint extends the same facilities to standard ASP.NET forms. These process-aware AgilePoint Web Controls are based on the standard ASP.NET Web Controls and are accessible from within Visual Studio. Further, developers can import an ASP.NET application and quickly convert it to work with an AgilePoint enabled process. This feature can support a Lotus Notes to .NET migration (converting a Lotus Notes application to SharePoint and InfoPath, or ASP.NET and then utilizing AgilePoint to rebuild the process definition and support its routing).

Through AgilePoint Developer, additional application-specific functionality can be added to an AgilePoint Web Control (or in combination) to create reusable, composite user interface controls that can be shared across multiple forms. These composite user interface controls can be easily configured to
implement an access control policy across users by controlling the visibility, the read/write permissions, etc. AgilePoint Developer can also be used to create Win Forms for the user interface. Developed ASP.NET and Win Forms applications are exposed in Envision as a resource item to associate with process steps.

3.4 Time

AgilePoint developers specify the desired relative or absolute time for the completion of an activity, providing a benchmark for performance analysis and improvement. The process designer can also specify an absolute deadline for the complete process. When a time out occurs at runtime (at the activity or process level), the system invokes a predefined escalation action. Alternatively, escalation can be dynamically assigned to a user-definable exception handling module (implemented as an AgileConnector through the AgilePoint API).

3.5 Process Optimization and Simulation

A simulation facility is provided within the Envision tool to provide a pre-production simulation capability to help business identify potential bottlenecks and predict cost allocations. Having specified the percentage splits at decision points, and the time/cost allocations, the tool exercises the model helping the user identify bottlenecks. Additional simulation enhancements will be supported in later releases of the Envision tool.

4 Business Rules

Business rules within AgilePoint are reflected in the default visual business rule object. This extensible dialogue allows the process designer to reflect any conditions required. Alternatively, custom business rules are developed in Visual Studio to override the default business rule object, or a reusable custom business rule object is developed as an AgilePart.

![Figure 9. Visual business rule object.](image)

AgilePoint can also integrate with a third party business rules engine through either Web Services or its API. For example, AgilePoint uses a generic Web Service AgilePart to access Microsoft BizTalk business rules engine. The configurable XML interface enables users to specify and bind process variables to the business rules engine.
5 Integration

The primary mechanism for integration of third-party applications into AgilePoint processes is through AgilePoint Developer (Visual Studio). AgilePoint provides the AgileStub and AgilePart functionality within AgilePoint Developer to facilitate this.

AgileStubs associate external functionality with specific process templates. AgileStubs automatically create the necessary skeleton for including user developed assemblies and classes. Existing Visual Studio projects can be upgraded to include AgileStub functionality, enabling them to be accessed by AgilePoint process models. Once the necessary development has been completed, AgileStub is exposed to Envision to allow its association with a process step. The assemblies and classes need to be available on the AgilePoint Server before the process template is deployed.

Alternatively (and probably more commonly), AgileParts provide an integration mechanism to embed external functionality that is reusable across process templates. An AgilePart encapsulates any desired functionality into a reusable Activity object, which is then made available within Envision-based models (designers then just drag and drop them onto process models). Effectively, AgileParts deliver an object oriented capability at the process level, enabling the business to leverage its existing IT assets in a reusable fashion, accessible by business managers and process designers (without needing to know how the AgilePart works). AgileParts can encapsulate past (pre .NET) developments such as VB, COM, C++, or even Java, allowing them to be leveraged as .NET powered BPM applications through AgilePoint.
When embedding AgilePoint functionality into third party applications (i.e., the reverse of the above), developers use Visual Studio and call AgilePoint APIs for either server-side or client-side functionality. APIs available include bindings for C#, VB.NET, C++, Web Services, Messaging Queues, COM, etc. When creating AgilePoint enabled Web applications, AgilePoint will also incorporate skeletons of process-related interfaces such as task management, process viewer, etc.

6 Organizational Structure

A pre-defined set of Roles (Administrators, Process Runtime Managers, Process Template Designers, and Users) is added into the system at installation. These are built-in roles that are used to provide basic access rights to different classes of users. Each of these built-in roles consists of a collection of access rights that can be further modified or customized. Additional Roles are added as deemed necessary.

When defining process models, the process designer either manually enters the Participant, or he selects an AgilePoint User, an AgilePoint Role, or an AgilePoint Group. Users can also select an Active Directory Group or select a user directly from the Active Directory or LDAP. The Participant can also be determined at runtime via a process variable – in which case, the name of the Participant is preceded by a $, e.g., $Participant_Name, which can be a user, role, or a group.

7 Process Adaptability

Unlike traditional code-generation based workflow and BPM tools turning static process models into rigid and monolithic executables that cannot adapt freely to changes at runtime, AgilePoint’s XML based architecture provides a variety and high degree of process adaptability supports that are keys to deliver business agility. AgilePoint Server supports versioning of process models. As new instances of work are created, the Engine copies the process model to support the case in hand. As a result, any updated version of the model will not affect existing work in progress. Moreover, this approach facilitates changes to the process model supporting the case in hand, should that be needed during execution.

Users can adapt the process in-flight, if needed, interacting with the model either through the AgilePoint API or via AgilePoint Enterprise Manager. For example, with Enterprise Manager, a user could bypass a task without performing the work, or roll back an already performed step. Further, a case can be suspended, resumed or cancelled. AgilePoint also enables the creation of user definable delegation rules via AgilePoint Enterprise Manager. If need be, the actual process model itself underpinning the case may be modified (by suitably authorized users).

Depending on the design of the model, users might be prompted to select dynamically an appropriate subprocess to bind to the parent at runtime. Alternatively, this could be driven programmatically or via business rules based on external events.

8 Process Lifecycle

AgilePoint Envision supports the deployment to more than one target server environment. This enables support for various stages, including development, testing, staging, production 1, production 2, etc.

Moreover, a separate component (Process Template Management) in the BPM Engine is provided to manage the lifecycle of the process models. The process models are tracked throughout their life (created, released, checked-out, checked-in, and retired). Only a released process model can be executed while all previous versions are retired. System Administrators, or users with appropriate permission, have full control over the deployment and versioning (facilitated through AgilePoint Enterprise Manager). If needed, the active version can be rolled back to a previous version. Reporting mechanisms can also be created to compare the performance between different versions.
9 Monitoring, Measurement, and Management Information

AgilePoint Enterprise Manager provides a collaborative hub and digital dashboard throughout the process lifecycle. It supports out-of-the-box support for audit, activity, and real-time tracking of cases. AgilePoint Enterprise Manager is a web-based AgilePoint application itself created in ASP.NET. AgilePoint Enterprise Manager functionality and interfaces can also be exposed through SharePoint as Webparts.

Figure 12. The AgilePoint Enterprise Manager provides a real-time monitoring window on the state of case.

AgilePoint lets users create user-configurable dashboards and reports and includes both real-time and after-the-fact reporting and analysis tools. It also provides information on the system status, server performance, application threading data, and monitoring.

Figure 13. Integrate dashboards provide management with a view of work in the system and past performance.
10 Templates and Frameworks

AgilePoint provides a number of out-of-the-box templates—for example, a number of document management and control templates to leverage the functionality of Microsoft SharePoint Server are offered. The AgilePoint stencil for Microsoft SPS (SharePoint) are implemented as AgileParts. Together with SharePoint, AgilePoint enables businesses to leverage a wide variety of out-of-the-box InfoPath templates to deploy general business process management applications such as purchase authorization, expense reports, etc., with virtually no code required.

AgilePoint OEMs are building vertical solutions to cover: Regulatory Compliance, Insurance, Document Management, Facilities Management, Financial, Legal, Life Science, etc.

11 Vendor

Ascentn was founded in 2002 with headquarters in Mountain View, California and offices in Japan, China, Taiwan, Spain, Germany, and a partner network throughout North and South America, Europe, Asia, and Middle East. At the time of writing, the company has nearly 100 end-user customers—with more than half multi-national companies including Global 2000’s and close to a dozen OEM relationships. Ascentn has also observed a growing number of its customers converting their first project or departmental based AgilePoint implementation into enterprise-wide process foundation standard in as short a time as 6 months from their first implementation.

12 Cost

Driven by the company’s value and usability objectives, Ascentn provides perhaps one of the lowest prices available in the industry, offering opportunities for significant price performance gain and ROIs. AgilePoint can be bought based on a fully configurable model. Out-of-the-box, AgilePoint provides 3 pre-configured editions – Starter, Professional, and Enterprise. Ascentn’s goal is to enable any company to gradually adopt and practice BPM with minimal investment up front and to scale quickly with confidence and manageable incremental investments. For example, the Starter Edition, configured to support up to 20 state-less concurrent users (comparable to capacity for up to 500 named users), is under US $10,000. Annual maintenance charges of 18% cover technical support and upgrades.
1 Product Overview

The eXtensible and Interoperable COordinator for BPM (XicoBPM™) is a web oriented BPM suite that is written in Java, runs on the Internet, and supports BPEL and BPMN. It is designed so that business analysts and developers can access product information and manage and maintain processes from browsers. The product is an integrated suite that includes modeling, simulation, workflow, and EAI definition and execution, rules, monitoring, and analytics.

B2Binternet's XicoBPM began as a document flow system in 2002. In 2003, BPEL and EAI were incorporated, and, in 2004, monitoring capabilities and BPMN were added. Version 3, being introduced in 2005, is a SOA-based version of the product that incorporates several additional features, including rules and more extensive organization management. The BPM Engine that underpins XicoBPM represents the 3rd generation of B2Binternet’s technology, and is the result of many years of expertise and millions of dollars of R & D investment. The engine has been architected from the ground up to manage many business transactions and support hundreds of simultaneous users. Figure 1 provides a conceptual overview of XicoBPM 3.

Figure 1. Conceptual Model of XicoBPM 3.
XicoBPM has been used in the development of several significant BPM projects in Asia, including applications for the Korea National Housing Corporation, and systems for Samsung Electronics divisions in Japan, South-East Asia, and Europe.

2 BPM Engine

The BPM engine of XicoBPM is run on a standard Web Application Server or as a Servlet Container using technology like Tomcat. The XicoBPM engine is web-based, and the entire suite is designed to operate in Service Oriented environments. Business processes are executed by means of BPEL, which is widely perceived as the most advanced process language. BPEL has strength and fairly flexible integration and is designed to leverage the advantages of an integration web services environment. Furthermore, ebXML is implemented to provide a standard business protocol when dealing with external partners. Thus, internal resources are orchestrated in BPEL (Web-Services) on the basis of a business protocol composed of BPSS (ebXML), which manages external resources. As a result of this comprehensive use of standards, XicoBPM provides an open technology platform on which companies can implement a vertical (end-to-end) business process that is easily linked to any external business elements. Figure 2 illustrates the technical architecture of XicoBPM. It is organized into 5 layers. A brief description of the technical specifications used to each layer follows.

The base of the XicoBPM 3 technical architecture is an Application Server or Servlet Container. XicoBPM will run on any standard Java application server. On the other hand, XicoBPM can also run in a Servlet Container, such as Tomcat, which is a widely used as the engine of many application servers. In addition, since XicoBPM has a separate SOAP server with its own internal application server, even greater flexibility is available, if needed.

Figure 2. Technical architecture of XicoBPM 3.
Just above the Application Server Layer is the User Interface Layer. This layer is packaged as a web browser. It integrates all of the graphic tools managers, developers, or users will need, including process modeling. Users can sign on with any standard browser and, using the XicoBPM Work Portal, can interact with the XicoBPM system. The XicoBPM browser interface supports – in addition to the basic Work Portal View – all of the other required views managers and users need, including an Organizational Model View, a Modeling View, a Rule Editing View, a Monitoring View, and an Analysis View, all unified by the web browser approach.

The Integration Layer rests on top of the User Interface Layer in Figure 2. The Integration Layer employs web service standards to assure easy integration. Integration can be described from roughly two different perspectives. One is from the Transport perspective, which includes Service Listener, Point & Service, Invoke Point, and other forms of Messaging, including converting, packing and enveloping of message, etc. From the Transport perspective, Listening HTTP, SMTP, and JMS are possible via the SOAP Server included in XicoBPM. And at the point of Invoke, direct invocation,, bounded to typical HTTP, JCO of SAP, or a relational database (RDB) like JDBC, is allowed. Thus, XML messages can be used directly with either a RDB or with SAP. From the Messaging perspective, XicoBPM is designed to enable messages of web services and ebXML to be converted and compliant each other. Furthermore, other messages frequently used in enterprises, such as Flat-File and EDIFACT are available and do not require extra development efforts. XML-Security is also implemented for external business protocol.

The fourth layer is the Process Layer. The Process Layer treats messages as events, which are passed via an event handler to the process layer, which starts running. The event handler of Process Layer analyzes the events and conveys them to the appropriate runtime engines. These events can be delivered either to the rule engine executing a proper rule process, or the process engine operating a process. In particular, this process layer allows ebXML events to refer to an appropriate BPSS and includes interface functions linking to a proper BPEL process runtime.

The top layer is the Model Layer. BPM serializes instances of each process onto a database or a file system for Long-Running-Process. The Model Layer serializes such a model, remodeling the serialized data and binding it. It handles not only processes, but also integrated data from user graphic interface as well as user organizational information. It abstracts a separate monitoring analysis model by process instance for monitoring and analyzing.

XicoBPM is designed with a clear set of layers and open standards to assure transparency and maximum flexibility. It can be easily configured or transformed to handle a wide variety of problems, and it can fit in and respond to future changes in corporate enterprise environments or to future changes in IT technology.

2.1 Platforms
XicoBPM can be run on all standard operating systems that support Java. Although it is usually based on a standard application server, that is not mandatory. It can also be based on a simple Servlet container. Most large process applications will use a database to manage the large volume of transactions, but a database is not required. Clients can choose to use a typical file system or other existing database.

2.2 User Interface
XicoBPM provides several different views for users, including the Work Portal View, Organizational Model View, Process Modeling and Simulation View, Rule Editing View, Monitoring View, and an Analyzing View. All of these views are executed on a HTML-based web browser. And, since they do not require Active X or an Applet on the user’s PC, they can simply be accessed via a standard browser, running on a standard PC from any possible location. The Web Browser GUI environment is straightforward, which makes it easy and fast for users to work together to develop or to monitor or manage business processes at any time from any location.
2.3 Scalability

Scalability involves both the server engine and the client tool. The server engine of XicoBPM can support a system with a small volume of transactions (e.g., 5 users, 5 multi processes, 1 file system). It has also been implemented, without any problems, to support 1000 users interacting with approximately 80 multi-processes. The client tool of XicoBPM is available via all of the standard web browsers. Since it is web browser-based, there is no need for users to bother to install a separate program. As long as the web server will support browsers, XicoBPM is available to clients who log in.

3 Processing Modeling

XicoBPM’s process modeling environment uses the BPMI’s Business Process Modeling Notation (BPMN). BPMN is an open graphical notation standard that is rapidly gaining international acceptance. It makes it easy for users to describe processes. Once managers are happy with process models, the models can be extended by developers and used to generate BPEL code.

XicoBPM's modeling view is divided into two sets of interfaces. The Business Process Design View is used by business analysts to create a business process model. (See Figure 3.)

As you can see in Figure 3, the left side of the screen displays a process that the analyst has created. The diagram is created by dragging and dropping process elements from the top right panel. The specifics of each process element are described in the property window at the lower right of the screen. Using this interface and the BPMN notation, a business manager or analyst can quickly describe a process.

The second process-modeling interface, the Business Protocol Design View, is used to define process choreography and orchestration. The analyst or designer begins by defining how the processes defined in the process design view will be choreographed using BPSS. This is called the Choreograph View. (See Figure 4.) Once the Choreograph View is defined, the Orchestration View tab is clicked, and XicoBPM generates the Orchestration View that shows how the process will be coded in BPEL.
The Choreograph View defines diverse business protocols and relationships with partners and creates BPSS. Once the choreography diagram is completed, the developer can use the Orchestration View tab to generate the BPEL and examine it in Orchestration View. Based on this view, each system is connected, users and tasks are assigned, and then a complete single business process is implemented. All of the views can be easily modeled by dragging and dropping elements from the graphical Activity Selection panel. Each activity can be copied, deleted, added, or changed, using Undo and Redo.

3.1 Subprocesses

A process can either import or call its subprocesses. Both methods are available within the modeling view of XicoBPM when one selects a subprocess call. Import is used to insert an existing subprocess directly into the process to be modeled, while Call is used to hold only a reference of subprocess which can be called dynamically when the process is executed.

3.2 Shared Data Space

XicoBPM can select and operate any common RDB or use a file system to serve as a shared data space. That is, users have the option to use a file system by model or a RDB as installation. Generally, a file system is recommended for small BPM system, while a RDB is recommended for BPM systems that generate lots of data.

3.3 Forms

The forms used in most applications are typically web forms, which are hard coded for each individual use by means of incredibly complex logic. XicoBPM manages and registers widely used web forms, including JSP-based forms and the XML-based XSL view. Currently, a tool generating these forms is not automatically existent; instead, MS InfoPath is recommended for users seeking an automatic tool. A form tool supporting Xform will be completed in the near future and incorporated in XicoBPM.

3.4 Time

The XicoBPM™ contains a scheduler and supports two time-relevant activities: Duration Time and Special Time. Both are used as in BPEL. The time relevant activities enable batch process or demon process and can be incorporated into the existing enterprise processes.
3.5 Process Optimization and Simulation

Once a process model is completed, it can be simulated. The simulation system runs in the Modeling View, and, therefore, users can easily use simulation to check processes they have designed. By using simulation, bottlenecks and redundant or impractical elements of the process can be eliminated or revised to eventually produce an optimized process.

4 Business Rules

XicoBPM 3 provides a Rule Editing Tool and a Business Rule Engine to make it easier to describe certain types of decisions and to manage complex flows. Rules can be imported from other Business Rule products. Rules can also be used to alert managers who are monitoring systems so that they can respond to internal and external situations promptly. The Rule Engine provides a framework that enables managers to respond promptly to real time changes.

The Rule Editing Tool provides a web browser-based graphic flowchart that makes it easy to create and edit rules. The rule diagram that the user creates uses BPMN notation. (See Figure 5.) The XicoBPM Rule Engine responds to requests for rule services. It can be installed as a stand-alone utility or added to the application server to work in conjunction with business processes.

![Rule Editing screen showing a rule.](image)

From the technical standpoint, the BPM Runtime Engine manages transaction processes, while the Business Rule Engine is activated by events and returns the result only upon a client’s request. Unfortunately, there are no widely recognized standards for rule engines. The rule engine of XicoBPM 3 is BPEL-based. Since the BPEL-based rule engine follows the standard XML data, it is possible to access from diverse applications.

5 Integration

XicoBP supports Web Service Addressing and Endpoint references that make it possible to integrate and cooperate with multiple other IT resources. It is possible for XicoBPM to directly invoke any database (e.g., Oracle, Sybase, DB2) that supports JDBC. XicoBPM also integrates flexibly with ERP modules from SAP, PeopleSoft, and Oracle, and can access data protocols like HTTP, SMTP, and FTP. It is also possible to use a directory such as Local Directory. In the BPEL Activities, Invoke, and Partner Links can all be integrated with other products.
6 Organizational Structure

XicoBPM includes an interface view for specifying an Organization Model. XicoBPM provides a graphical, tree type organizational view that makes it easy to understand and edit the organizational model. Using this model, one can specify each user’s access, views, and roles, and specify the flow to and from employees.

Figure 6. Management screens show organizational information.

7 Process Adaptability

XicoBPM is highly adaptable. It maintains BPEL atomic activities as objects and dynamically binds activities at runtime. Users can modify processes or subprocesses to support flexible case handing. End users can create their own activities at runtime.

8 Process Lifecycle

XicoBPM is designed to support the complete business process lifecycle. The product is a single, integrated package with uniform interfaces. A user logs on once and has access to all the functions of XicoBPM. The product supports version control and allows managers to modify activities at any time.

9 Monitoring, Measurement, and Management Information

XicoBPM provides a Monitoring View that lets process users and managers monitor processes. This real time process monitoring view enables users to trace process events as they occur. The Monitoring View uses the BPMN notation, which makes for a more intuitive monitoring of process. A manager can trace process events for an entire process or for a single, selected activity. The information is displayed on the Monitoring View within an Audit Trail window.
The Analyzer View is used to present data about a process instance. How the developer assigns conditions and input data is collected as the process is completed. Analysis data is typically summarized as a Table, Line, Pie, or Bar graph that reflects a specific Key Performance Indicator (e.g., processing time, etc.) assigned to systems or users. Besides this kind of general analysis, if specific numbers or values are registered when the process is modeled, it is possible to analyze those values as well.

10 Templates and Frameworks

XicoBPM groups activities into patterns or templates, termed as tasks. In effect, tasks function as reusable process components. The product comes with some horizontal and vertical tasks, and companies can develop others to simplify their own development efforts. Use of predefined tasks can make it easier for business managers to quickly define processes.

11 Vendor

B2Binternet, Inc., was founded in 2000. It has 113 employees, and it earned $8.2 million in 2003. Its headquarters is in Seoul Korea, and it has a major branch office in Beijing, China. It has distributors in
the UK, Russia, Singapore, Malaysia, and Thailand. The company began to appear at US BPM meetings in 2004. Obviously, this company has considerable experience in Asian markets. For information on its Chinese operations, check: www.b2bbeijing.cn

12 Cost

XicoBPM costs between $40,000 and $75,000 for one CPU. This price does not include consulting services and maintenance. A pilot system is available for under $25,000.
Chordiant Enterprise Platform

Version: 5.6

Chordiant Software, Inc.
20400 Stevens Creek Blvd., Cupertino, CA 95014
Tel: Tel: 408-517-6168 Fax: 408-517-5032
Web: www.chordiant.com Email: paul.burrin@chordiant.com

1 Product Overview

Chordiant provides both a core BPM Infrastructure Suite and a set of process enabled Applications. Chordiant Enterprise Platform is a comprehensive Business Process Server BPS that orchestrates operational business processes across the extended enterprise, from initial interactions with customers across multiple channels, through to fulfillment in back office processing centers.

The suite includes modeling tools for both business processes and rules, along with robust business activity monitoring and administrative tools. The core process engines sit on top of a sophisticated integration functionality that uses pre-built connectors (adapters) to leverage and integrate existing systems into process models. Typical installations feature 2,000 – 10,000-plus users in process intensive environments.

Chordiant’s Applications sit on top of the BPMS and are focused in the Retail Finance arena. They include Chordiant Card, Chordiant Contact Center, Chordiant Retail Channel, and Chordiant Marketing. The Applications can work together (or separately) and are composed of mature process models, business rules, and configurable employee interfaces that are used out-of-the-box and/or are customized and configured to meet the needs of the firm. Indeed, given the target market for the applications, it is expected that customers will pick and choose the components and parts they require.

However, much of the underlying functionality of these packaged solutions is readily applicable in a wide variety of customer-facing situations (outside of Retail Finance). Chordiant has made these generic capabilities available as Business Services that can be reused by customers building BPM enabled environments targeted at other vertical markets. In a sense, Chordiant has included a generically applicable object model that facilitates the rapid development of BPM oriented applications. This level of support for the development of applications is unique amongst the vendors surveyed. For a short summary of these generic application capabilities, see the Templates and Frameworks section.

2 BPM Engine

The entire suite is delivered in a robust Services Oriented Architecture (SOA) based on J2EE standards with the latest version leveraging Web Services functionality throughout. Architecturally, there are two primary layers:

- **Interaction Management** layer, which encompasses process definitions, business rule definitions, and supporting infrastructure to coordinate services and applications.

- **Chordiant Services** layer, which is where core BPMS functionality such as the Business Rules Engine, the Process Execution Engine, and Integration components reside.

This is complemented by a set of Role-based Desktops (out-of-the-box user interfaces oriented to different types of users), as well as a set of templates, tools, and infrastructure components for creating and connecting role-based applications (UIs). As you would expect of a vendor focusing on the needs of retail banks and insurance companies, integration is a strong area of expertise.
The Business Activity Manager and Administration Manager provide management information and are used to fine-tune resource utilization, and they control how work is processed in the system. Tools such as Chordiant Business Process Designer, and Rules Designer, together with the Integrated Development Environment, complete the picture.

Chordiant’s applications sit on top of this infrastructure to deliver out-of-the-box application functionality designed for the Retail Finance community. Supporting much of that functionality is a collection of pre-developed Business Services. When building new applications or process functionality, developers will usually customize the presentation of these Business Services. A wider discussion of this concept is available in the Templates and Frameworks Section.

For each Process, there are two distinct layers -- the Service layer and the Interaction layer. The Service layer describes the wider process from end-to-end, and may include system-oriented tasks of retrieving data, etc. On top of this, the Interaction layer defines the user interactions, which may be rendered differently, depending on the sort of device profile of the user.

The core functionality is delivered through a set of engines running as system services. At its heart is the Process Execution Engine (the BPS), which is tightly integrated with the following:

- **Business Rules Engine** – responsible for automating decisions and applying policy rules (defined externally to process definitions).
- **Queue Definition Services** – responsible for managing queue properties and for driving how work is routed to queues, which are ultimately distributed to users or system resources.
- **User Profile Services** – responsible for managing group, role, and skill associations with users to facilitate assignment and management of work.
- **Routing Engine** – responsible for assigning work to available resources or queues.
- **Queue Service** – responsible for managing the work in queues and distributing work to users or system resources.
- **Timer Engine** – responsible for tracking time against process instances and invoking appropriate rules.
- **Session Manager** – responsible for managing resource availability.

Out-of-the-box, Chordiant provides a range of customizable end user oriented client applications, such as Chordiant Contact Center, the Business Activity Manager, and the Administration Manager. These applications (and any custom-built client applications) are based upon the Chordiant Common Application Framework Environment (CAFÉ).

CAFÉ provides a generic set of front-end components that work together effectively to support role-based applications. Depending on the role(s) of the user at login time, CAFÉ composes the desktop environment, providing the features and capabilities that have been defined for that role. For example, should the user have anything to do with telephony, what other devices are available (in a bank this might be check or card readers) and what style of desktop is to be used (heads-up or heads-down, low detail, high detail, etc.) CAFÉ populates the desktop with the processes and work queues that the user is allowed to access. CAFÉ resolves the user interface for each process step, as defined in the process definition and passed to CAFÉ from the BPS.

Web Services are used widely within the product for a variety of functions. They are or can be used to invoke business rules; to invoke processes and subprocesses (processes can be exposed as Web Services); and to integrate third party applications into Business Services (and then expose them again as Web Services).

### 2.1 Platforms

Chordiant supports a range of industry standard platforms including IBM WebSphere, BEA WebLogic, Sun Solaris, IBM AIX, Linux, Microsoft Win2000, IBM DB2, and Oracle.

### 2.2 User Interface

Chordiant offers multiple user interface options, including focused end-user oriented applications (such as Chordiant Contact Center), operational tools (Business Activity Manager), and administrative tools (Administration Manager).

The heart of the Chordiant Desktop is a dynamic, role-based environment for users. The context of the Desktop changes, depending upon what particular activity is currently being performed. This allows agents to perform blended roles, such as dealing with inbound customer service telephone calls, as well as inbound emails and outbound sales telephone calls, or inbound credit card service calls. The appropriate elements of the Desktop change dynamically, reflecting the activity currently being undertaken. The Desktop is rendered on the fly, depending on the needs of the process instance in hand.

Core capabilities of Chordiant role-based applications include

- Combined process user interface and customer profile user interface within a single browser window, dynamically guiding users through processes while maintaining a constant display of customer information to improve service speed and quality.
- Support for multiple, simultaneous active processes, enabling users to start, continue, and manage processes in parallel.
- Display and management of user tasks in various Queues including the concept of Inbox or personal work lists. Indeed, Queues can contain virtually any type of item, whether it be a task, email, call, note, bring up item, etc.
• Deferring and transfer of work and processes, including work that involves active phone communications

Figure 2. The Chordiant role-based desktop combines both process and customer data oriented views, rendering the user interface on the fly based on the needs of the worker and Task

If needed, new user interfaces are developed using CAFÉ. It can also leverage existing templates, or build on top of complete applications, allowing an approach that accelerates the construction of custom user interfaces. Creating new vertical applications typically involves:

• Leveraging Chordiant JSP tags and GUI components (CAFÉ provides an extensive library of reusable DHTML behaviors such as menu, tree control, sortable table, tab control, dialog box, and date picker) and using a standard HTML/JSP editor to create unique content for the main body of pages

• Leveraging CAFÉ’s support for event management, windows management, skins, user preferences, and desktop settings, adding configuration data appropriate to the custom user interfaces

2.3 Scalability

The bulk of Chordiant’s server-side code, including the process execution engine and the business rules engine, runs under an application server to leverage the scalability and high-availability capabilities inherent to the application server. This means that Chordiant can take advantage of significant processing resources that may be spread across multiple nodes and geographies. Benchmarks validate that Chordiant solutions can scale to 20,000 users, over 6 Million business operations per hour and over 600,000 business process tasks per hour.

3 Processing Modeling

Processes are composed by selecting Tasks (Activities) and defining the sequencing logic. Based on the structure of the Shared Data Space, the input and output data requirements of each Task are known to the BPD, which then guides and validates the assignment of inputs and outputs to process variables and/or literals. The resulting process models are stored as an XML file.
Each Task is assigned routing properties that are evaluated at runtime and send work to a particular Queue. The routing information for Tasks can include routing information based on runtime data – customer profile, or other instance-related information, rule results, etc. – that determine the destination Queue, and, ultimately, the user who will perform the work.

![Business Process Designer](image)

**Figure 3.** The Business Process Designer offers a rich visual environment for defining process flows, integrating relevant services and user interfaces to manage customer interactions.

There were several interesting features available within the BPD, including the ability to set a range of conditions on transitions. Rather than opting for the normal IF style condition, Chordiant also includes *While* and *Switch*:

- **While** is an iterative condition that executes a task or series of tasks until the condition is satisfied. For example, the condition WHILE done=no, prompts an online shopper to indicate whether he/she is done shopping. When the answer is “yes,” the condition is satisfied and control passes to the next task.

- **Switch** provides the option of conditional branching, where each branch is evaluated and fired based on a different expression. The mode for a switch type can be set to OR or XOR. When the mode is set to OR, all tasks that have valid IF conditions are completed. When the mode is set to XOR, the IF conditions are evaluated until the first valid expression, which is then executed, and further evaluation is cancelled.

The semantics also include a *Compound* task type that groups together a series of individual tasks that must be completed together before the process can move on. A Compound task can also contain nested Compound tasks.

The BPD also provides the ability to add pre-defined Tasks to a Templates palette. These can then be reused whenever and wherever needed throughout the process architecture.

### 3.1 Subprocesses

Chordiant supports multiple approaches to subprocesses, including embedded subprocesses within a parent process and separate subprocesses that are called from steps/activities in other processes. The following is a sample of a few different approaches:

- **Completely embedded** – Subprocesses are defined completely within the parent process in the parent’s process definition.
- **Linked** – Subprocesses are defined or designed separately from the parent, but there is a direct link from the parent to the subprocess. Effectively, this is asynchronous chaining of processes.

- **Service-Wrapped Process** – Subprocesses are invoked (instantiated) from a step/activity synchronously.

### 3.2 Shared Data Space

Initially, the Business Objects and Business Services of the domain are modeled using an external modeling tool such as Rational Rose®. These are then generated as Web Services and made visible to the Business Process Designer. Effectively, this creates the SDS structure for the process. If one wanted to incorporate the data structure associated with an external service or form, then that would be done in the external modeling tool. The product supports the creation of arrays from any object type that is serializable in Java.

### 3.3 Forms

Chordiant supports forms built with 3rd party tools as well as Chordiant Interaction Designer. In practice, customers would probably use the CAFÉ environment to enable data captured at the web tier to be passed to and processed at the EJB tier. For a wider discussion of CAFÉ and its capabilities, see the User Interface section below.

### 3.4 Time

The BPD provides a wizard to define the desired absolute or relative time deadline for a Task. Timers are instantiated at runtime and can accommodate runtime parameters. Timer expiration can be handled in a number of ways, including alarms, general escalation (push work to next available, qualified user), and specific escalation (send to manager or specialist expediter).

### 3.5 Process Optimization and Simulation

Chordiant’s BPD incorporates a pre-production simulation capability that can help the business optimize processes using *what if* scenarios and other analysis tools to identify improvement opportunities before that process is ever deployed. The core process engine is used as the simulation engine acting on the actual process description (rather than exporting the model to a third simulation environment).

Note: This is really a developer’s tool rather than a generic simulation tool aimed at end-user management.

### 4 Business Rules

Business Rules (beyond process branching logic) are managed with Chordiant Rules. A distinct Business Rules Designer is used to define and ensure rule integrity. Once developed, these rules are then made visible to the BPD for inclusion within business processes (rules are executed at discrete decision points within the process by the BPS – invoked directly from within the process, through Java code or Web Services). At runtime, the Task calls the runRules method (or WSDL description) with the appropriate Ruleset name and a table of input and output objects required by the Ruleset.

To build business rules, the *vocabulary* of the business domain is imported from Rational Rose®, via XMI (the SDS structure). On top of this structure, it is possible to add further relationships between these objects and their properties before checking the integrity of the vocabulary and beginning rule construction. Rules are then built based on these known objects and their attributes (each process instance will have values that map to these object attributes).

An example of a rule set might revolve around a call-center user managing credit card transfers. Business experts would define the rules that govern whether a special rate should apply, based on the amount being transferred, and whether the customer is considered high-medium or low value, etc. Based on
these sorts of criteria, the bank might offer other services, or transfer the customer call to a special group of users. Rules might be developed to govern the capabilities of the user, or to provide the user with suggestions for cross-sell offers. Other rules might be constructed to support sophisticated routing, ensuring that appropriately qualified users receive the work item.

Practically speaking, the Business Rules Designer is used by domain level experts, such as specialist business analysts or expert end-users. It is not really applicable for general end-users, which is probably not a problem, given Chordiant's target market.

5 Integration

Integration between Chordiant and other products comes in a number of flavors. One of the core concepts within Chordiant is the ability to reuse and access common Business Services. (For a list see the Templates and Frameworks.) Business Services can be exposed to external systems as Web Services. They can fulfill functionality in processes managed by external systems, or simply be consumed by third party applications.

Customers can develop their own Business Services that act as the integration points to third party applications. To do this, Business Services in turn leverage Connectors to access third party applications such as CICS, MQ Series level. The Connectors are JCA (Java Connector Architecture) compliant, enabling customers to build their own, or, now through Web Services, to access third party applications via the Web Service JCA Connector.

Rather than call a Business Service directly, Chordiant uses a Client Agent (a Java class) to expose the interfaces of Business Services within the process-modeling environment (the BPD). Client Agents serve as proxies and are used by both process-oriented applications (or any other sort of application) and by Business Services themselves contacting other Business Services.

Architecturally, Chordiant has adopted single bean architecture, so the customized Business Services are really Java classes. This is in contrast to the usual procedure for developing a conventional EJB, which requires programmers to compile and deploy the EJB to a J2EE application server when adding a new service or changing service interfaces. By using a single EJB to host all services running as Java classes, developers can introduce new Business Services without having to reconfigure the EJB. Also, since the
Business Service is an implementation of a Java class, they can develop, test, and run the class independently of J2EE.

Of course, Chordiant processes themselves can be launched from external systems (applications, portals, etc.) via Web Services, and data can be exchanged between systems via such mechanisms as JMS.

### 6 Organizational Structure

Administration and security for the Chordiant solution covers the usual capabilities of general system administration, user profile and queue administration, access control to functionality in the development environment, and access to BAM and Administration Manager.

The Administration Manager is a web-based application that provides authorized users with the ability to manipulate user profiles, including assignment to Groups and Roles, the processes to which users will have access, and authorization to use administrative and operational tools such as BAM. Queue administration is also performed via the Administration Manager, enabling control of routing properties, queue status, and queue resource assignment (who is eligible for work for each queue).

Authorization in the development environment is handled at two levels: authorization to use the development tool and authorization with respect to each product asset (for example, each business process definition).

The organizational structure of the business is normally imported from LDAP, Active Directory, or wherever else the firm may store this information (e.g., PeopleSoft). Integration of third party sources or organizational structure is achieved in the same way as any other application integration.

### 7 Process Adaptability

If desired, users have the ability to defer work, either for a fixed period of time or until some other event happens. The Chordiant approach at the user interface level enables the user to view multiple processes against a given customer, creating a case-handling environment where all threads of work are managed in one comprehensive view.

### 8 Process Lifecycle

Process definitions built with the Chordiant BPD that are deemed ready for deployment are loaded to the destination production system and are instantiated by calling applications. Any in-progress process instances will continue to execute according to the process definition at the time of instantiation.

Process definition versions are managed as XML files by an enterprise version and configuration management product, such as IBM’s ClearCase®, which is used to manage the entire spectrum of product assets.

### 9 Monitoring, Measurement, and Management Information

Chordiant’s Business Activity Manager (BAM) is a web application aimed at the line of business manager. Beyond capturing audit data – such as resource owner, task/activity ID, process ID, time stamp, etc. – the BAM system provides multiple views of work in the system along with the ability to filter work in the system. Managers can move work to a different queue and/or assign work to a specific resource to solve short-term resource allocation issues.
Chordiant also has capabilities built into the Chordiant Contact Center application that monitor activities related to customers, including historical events and current process activities. While BAM provides a view of work that is organized by type of work and by the resource/user, Contact Center provides a view of work that is organized by customer.

Chordiant solutions provide a comprehensive set of horizontal and vertical templates and frameworks focused around the needs of Retail Finance. These packages reuse pre-developed Process, Tasks, and Business Service functionality that are usable out-of-the-box, as well as providing start points for customized solutions. For example, a vertical application such as Chordiant Card includes a set of complete bespoke process and rules definitions that are applicable to credit card dispute processing (e.g., Chargeback and Dispute modules). These vertical solutions also include custom-built user interfaces and Business Services that are orchestrated by the process models. Available packaged applications include Chordiant Card, Chordiant Contact Center, Chordiant Retail Channel, and Chordiant Marketing.

Underpinning all of these applications is the CAFÉ framework. It reuses the functionality of the Business Services to deliver integrated capabilities to the user interface application. A quick summary of the Business Services supplied out-of-the-box follows:

- **Account Service** – helps to authenticate, retrieve, create, and close an account
- **Customer Service** – handles customer information management and their interaction with other business services, like Account service and Product service
- **EBC Interaction Service** – captures information about customer interactions with an Enterprise Business Centre (EBC)
- **Establishment Service** – retrieves an individual business entity or all business entities. It also helps to retrieve all delivery methods, all payment methods, business contact information list, and all country, province, and language related information.
- **Guide Service** – provides agents with guidance, such as instruction set, scripts, and prompts. Each instruction set, prompt, or script must associate with a context, such as a particular Task or an offering. Instruction set contains work steps that advise agent.
- **Location Service** – retrieves country, province, and language related information by providing specific country code, or ISO code, etc.
• **Offering Service** – manages Offerings, Offerings Categories, and Offering Views. An Offering is any product or services provided by an Enterprise Business Centre (EBC).

• **Order Service** – The Order Fulfillment Service allows a user to start the fulfillment of an order. It also provides a way to find the delivery methods available for this order based on the business entity of the party that made the order.

• **Order Generation Service** – used to create, retrieve, submit, update, cancel, and delete Orders. It also provides functionality for looking up cross-sell products for items in an order and substitution functionality for order line items that are not currently available.

• **Order Tracking Service** – allows a user to get the current status of an order and find all order numbers for a given customer, or to find the order number of a specific order.

• **Product Service** – provides information on product, product details, product catalogue, and product category and package.

11 Vendor

Chordiant Software was incorporated in May 1997, with roots in its US-based software integration business, J. Frank Consulting, which was founded in 1985. Chordiant’s Initial Public Offering was in February 2000. Chordiant is a profitable organization with annual revenues of $68.3 million in 2003 and full year revenue guidance for 2004 of $80-$84 million. The Company serves some 180 customers worldwide, most of which are Global 1000 companies within the financial services sector. Products are distributed and supported worldwide, with regional offices in Boston, Chicago, New York City, Mahway, NJ, Manchester, NH, London, Paris, Amsterdam, Madrid, Munich, and Frankfurt. Chordiant currently has 273 employees worldwide.

12 Cost

Pricing levels are highly variable. If the customer elects to commence with a proof of concept or small-scale deployment, the price could be in the range of $500,000-750,000. If the customer chooses to undertake an enterprise-wide, mission-critical solution, a typical implementation will cost over $1 million.
1 Product Overview

Tranzax™ is a fully integrated and functionally sophisticated, enterprise-class BPM environment developed specifically to allow total automation of complex case centric work patterns found in back office operations (particularly in the financial services industry & government). Out-of-the-box, the patented product provides a fully functional case-handling environment (with multiple procedures associated with an individual case of work). It combines a unique approach – with business rules, process, data and event management – that allows firms to replicate the repetitive work carried out by humans, automating the non-value adding activities that are so prevalent in the back-office.

Through an inherent ability to replicate complex patterns of work that would normally be uneconomic to automate using traditional programming or BPM approaches, Tranzax can totally eliminate errors and costs from large tracts of complex non-value adding work. Tranzax also raises the quality and timeliness of high value work through direct automation and process coordination of all participants.

The product is based on the premise that information about a case of work is seldom complete and that tasks are rarely performed in the same sequence. Tranzax incorporates a cascading hierarchy of integrity checking, such that, when information on a case is captured, the system automatically evaluates relevant business rules, and fires off appropriate procedures (that are only valid at that level of information completeness).

Back office operations are characterized by incomplete data. But most other applications and packages make an inherent assumption that data will be organized and completed, screen-by-screen. When it is not complete, people have to compensate somehow. Inevitably, they develop manual procedures to work around the system – in effect, developing their own extensions to the process to handle these situations.

So, in Tranzax, data, rules, processes, and events all interact with each other: A rule or procedure can change the data, and changing the data can cause a rule or procedure to run. An event is interpreted in the context of the case data, and the system will automatically respond by invoking an appropriate procedure, having evaluated the related rules. The state of the information held about a case will influence the sort of capabilities that different roles have and how the user interface looks and behaves. All of this is achieved through configuration without resorting to programming.

Tranzax incorporates Clear Technology’s unique approach to process automation called Role Replication. The Tranzax Runtime Server ships with the following companion applications:

- Visual Business Workbench for rapid code-free configuration.
- Deployment Wizard to support development, test, and production phases.
- Integration Points to support inbound and outbound messaging, typically XML-based.
- Integration Simulator, to allow unconnected configuration and testing of links to other systems running in a simulated environment.
2 BPM Engine

The Tranzax Runtime Server is a state of the art J2EE server platform, featuring well-accepted industry patterns, standards, and extension points.

Key server components include

- Production Process Engine with inherent load balancing, fail over, and restart. The Process Engine supports automated or batch procedures, interactively initiated procedures, and procedures initiated externally via a published web service. The engine supports any number of concurrent threads per case instance as may be required.

- Process Case Handler maintains a continuous, real-time view of all process data without duplication and regardless of location. Case Handler understands the entire set of fine grained state attributes for all data elements, and the complex data validation patterns related to them. A single view of all process data enables tight management and control of all updates and data persistence.

- Business Rules Engine developed from the ground up by Clear Technology. It resolves a range of complex business decisions as it also supports conditional process branching functionality.

- Integrated Workflow functionality, including in-line, code-free, dynamically generated Browser Pages for all user interaction.

- Administration Console to perform scheduling and monitoring, manage users and teams, control system logging, manage simulation data, deliver alerts, and co-ordinate archiving.

The Tranzax Runtime Server collaborates with standard application servers to present the web pages generated to form the Tranzax end-user interface. End users interact with Tranzax via their standard web browser.

Each instance of the Runtime Engine is installed under a specific “environment,” and can be mapped to one or more “domains.” Each domain consists of one or more zones (Configuration, Testing, and/or Production). Individual components are “promoted” from one zone to another to control their deployment. Additionally, the product supports the concept of a “remote” domain, enabling developers to work on remote computers without having to be connected to the primary environment.

In production, all processes and associated rules are fully generated Java.
2.1 Platforms

Tranzax is available on Windows, Linux, and UNIX. Application Servers supported are JBoss, & Websphere. Database environments are DB2, SQL Server, and Oracle

2.2 User Interface

The Tranzax User Interface called “CaseAgent” is a thin-client browser application that interacts with the production web servers via JSP technology. CaseAgent is designed to support natively a number of modes of system interaction including

- Role based work allocation – either driven by the system or user selected from queues.
- Wizard style, rules-based guidance to enforce process policy.
- Ad hoc case interaction for call centers.
- Volume data entry mode for bulk information load.

All modes are supported by the same interface and can be mixed within a single session to suit specific business requirements.

Definition of CaseAgent screens is a fully integrated feature of the Tranzax Workbench and requires no coding or design skills. All screens are dynamically generated at runtime from layout information provided at design time and current state case data. In the Tranzax approach, “context” and “state” have a large part to play in guiding systems behavior. The user interface is built at runtime based on the information known about a case of work and configuration options set up at design time. This method enables the user interface to reflect the subtle changes in the information held on a case of work. For example, if the data on the case has moved on – say, because the interest rate for a loan has been calculated based on the then prevailing conditions – then that element may be grayed out (locked) on the screen. So the behavior of the screen reflects the state of the case. It will not let users go past data that is required, but could allow them to ignore data that has been deemed optional. All of this is configured directly without any explicit coding and may change throughout the life of a case.

Figure 2. The user interface is dynamically generated based on the context of the case data

Logical screen sequences are organized into page groups represented by a single step within a procedure. Page groups can be configured for wizard style navigation within that group of pages or configured into more complex interactive procedures where more complex business rules and actions are inserted between pages groups to control the sequencing and behavior of the user interface.
The CaseAgent user interface delivers a set of “pages” (shown on the left in Figure 2), providing information about the case with default frames for a snapshot of case data, a tree structured view of all related documents, and the main data entry screen. This is organized into one or more horizontal panels that support automatic layout of data fields and prompts by column count. Developers can also insert complex, nested tabular grids and forms into these panels (again without coding).

Work Pages presents the user with the work that they have access to in the system. For each role that the user has, a tab is generated across the top. Within each tab, by the default, the user will be presented with a list of interactive procedures that they can initiate, a list of pre-built searches with actual cases listed in the desired format (effectively work queues), and a list of previously interrupted sessions and URL links to other pertinent sites and pages.

At runtime any number of users can access part or all of a case with full record locking support. Each session will finish completely or rollback to a configured point in the controlling interactive procedure or remain in an interrupted state to be cancelled or completed at a future date.

2.3 Scalability

Tranzax scalability is primarily accomplished with industry standard techniques like clustering and load balancers, but enabled by the standards-based and conforming architecture of Tranzax itself (J2EE). A Tranzax production environment can run on a single machine but is more likely to be organized into three computing clusters – a database server group accessed via JDBC, a process server group running the core processing logic, and a web server group managing the JSP interactions.

Standard load balancing techniques can be applied to support user sessions across the web servers, while clustering and RAID strategies are available for the process and database server groups respectively. Tranzax requires no modification to run in any of these environments.

Process integrity is enforced granularly at the step level. Every step has full ACID transactional integrity and will either complete or fail in entirety without disrupting the state of the Tranzax Case Data store or any linked legacy systems or services. Steps that have rolled back will be automatically pulled and run on another process server at the first opportunity.

3 Processing Modeling

Figure 3. Solutions are configured using the Tranzax Business Workbench, which handles virtually everything required to develop a comprehensive case handling solution
The Tranzax Business Workbench is a fat client side application that allows multiple analysts to work online or offline, while sharing a central configuration repository. The Workbench presents a tree view of the components that are built and configured to create the overall Tranzax solution in the Tranzax Database. In turn, this information drives the operations of the Runtime Engine. Process development is one part of that environment. Developed processes are compiled to Java executables and deployed along with the engine.

Data PAKs are discussed in the Shared Data Space on page 98: At the heart of a Tranzax solution is the structured information related to cases of work (Case Files). A Case File will likely contain a number of “Documents” which contain repeating “Sections,” which in turn contain repeating “Elements.” Logic PAKs are discussed in the Business Rules section. Presentation PAKs form the core of the User Interface. Procedure and Event PAKs are used to reflect the procedures that are run as part of the case. Each area is supported with a number of configuration tools.

Procedures are built as a collection of “Steps” connected by “Transitions.” Step outcomes determine which Transitions are followed, and thus control the path that is followed. Procedures are either “Interactive” or “Automated.” Template Procedures are used to define standard pieces of functionality that can be pasted into new Interactive or Automated Procedures. Interactive procedures involve human interaction and typically contain Page Group steps assigned to different roles. Automated procedures are fired off by the scheduler, other procedures, or inbound Web Service messages.

A characteristic icon represents each Step type. When Steps are first defined, the icon is initially grey. Once the Step is fully configured, the icon is changed to its full-color representation. The “Event Context” controls whether it will operate at the level of entire Case Files or specific Documents.

Step types include Make Decision, Check Case State, Execute Service (call an XML Service see Integration on page 56), Create Case Contents, Manage Case State, Raise Event, Capture User Response, and Present Page Group. In the Automated procedure type, a Wait step will cause the procedure to pause until a specific condition is satisfied (based on either Time Frame or Case State).

A “Document Lock” option enables the developer to lock related Documents for the duration of the procedure, preventing others from overwriting its data. By default, Tranzax automatically locks Documents as they are accessed, releasing those locks as soon as the change is saved via a Commit step. The Document Lock option allows a more robust locking behavior, at the cost of making locks more difficult for other Procedures to obtain.
Tranzax uses “Events” to respond to changes in state. Beyond their name, Events are associated with a “Response Point.” When an Event is raised, it will signal the Response Point for that Event in all procedures that are processing in the same Context. Context is inherited from the procedure that raised the Event (either at the Case File or Document level).

### 3.1 Subprocesses

Using a Sub-Procedure step, procedures can invoke any other type of procedure. The product handles both synchronous and asynchronous interaction with sub-procedures. Further, the parent procedure can invoke the child in a loop that runs “While” a specific business rule is true, “Until” a rule becomes true, “For” a specific number of iterations, “At Least One” iteration, or “Indefinitely Until” a timeout event occurs.

Optionally, each procedure can express one or a number of Event initiated flows. Any instance of a case being processed (using that procedure) when the named event occurs will have its flow of control handed to the event flow. Events will propagate back up the calling tree, initiating appropriate event handling at all levels and optionally returning to the interrupted point or end asynchronously.

### 3.2 Shared Data Space

Although simple in concept, complex case data management is probably the most powerful enabling feature of Tranzax. By tightly managing all data states, local and remote, the Tranzax process and rules engines can, in turn, be confidently applied to complex problems without excessive configuration.

Tranzax organizes process data into a hierarchical structure called a “Case.” A Case is analogous to a binder or folder in the physical world and may contain one or a number of Documents (each of which may have some repetitive count from one to N, or unlimited). Each document can have any number of nested Sections (Sections may also be repeating). Sections can define business data stored locally (in Tranzax) or point elsewhere to systems where the primary data store resides. Connection, caching, and updating policies for each Section are configured and associated with an XML Service.

![Diagram](image)

**Figure 5.** The Data PAKs are the point where the structured data of the case is captured and stored.

The basic data unit is the “Element” of some standard data type (text, date, time, currency, numbers, Boolean, lists, etc.) Arrays are supported through the repeating nature of Elements and Sections. Elements can be designated at design and/or runtime as locked, required, or optional. As data entry and messaging occurs, Element values change value and state. When a required Element changes value, a
validation rule fires automatically. When all required Elements in a Document eventually exist in a valid state, a Document level rule set automatically fires to confirm data quality and initiate appropriate procedures. This processing model, driven by data value changes, maps very well to the real world of complex back office processing where incomplete data is the norm (rather than the exception).

All data definition and related functionality is organized into a single editable unit called a DataPAK. DataPAKs contain the document and section schema definition, data typing, validation rules, repeating behavior, and external access policies. A DataPAK contains all process relevant data that a worker needs to perform his or her role (or Tranzax needs to replicate that role).

3.3 Forms

As explained earlier, Tranzax interacts with participants using a functionally rich, JSP-based, thin-client browser called CaseAgent. Definition of CaseAgent screens is a fully integrated feature of the Tranzax Workbench and requires no coding or design skills. All screens are dynamically generated at runtime from layout information provided at design time and current state case data.

Page Groups are sets of CaseAgent pages that guide Workers through the interactions needed for Case processing. Pages contain Field Groups, which contain Fields. The Field Group structure maps, both conceptually and literally, to the DataPAKs structure of Case Files/Documents/Sections/Elements. However, a top-level non-repeating Field Group may be configured to contain Elements from any top-level, non-repeating Section.

One of the types of pages available, the Work Page, is used to control access to information by Role. A Role can have a number of Work Pages, which are displayed in an order governed by the associated priority.

Tranzax does not natively support loosely coupled forms environments like xForms or InfoPath, but these could be easily incorporated via the standard Tranzax XML External Service step.

3.4 Time

Tranzax uses a UTC time system to support global process operations. The Automated Procedure is used to support a wide range of synchronization patterns found in manual processes. The Wait Step
causes a procedure to pause until a specific condition is satisfied, based on either “Time Frame” or “Case State.” The Time Frame option allows for a fixed period since the Case was created, or when the Wait Step itself was created. It is also possible to configure the step to pause until a specific Event is triggered. The Case State option will pause processing until an associated Document is in some specified state (Complete, Valid, etc.) This kind of Wait step also has a time limit; if this limit is exceeded, it will trigger a Time Limit Exceeded Transition.

When calling a sub-procedure, Tranzax can synchronously apply a number of waiting strategies. It can wait until (or while) a rule is true, and it can wait for the procedure to run a number of times (or at least once). It can also wait for a specified length of time from the date/time the Case was originally created or from the point the sub-procedure was invoked.

### 3.5 Process Optimization and Simulation

Optimization can be performed in real-time by altering in process parameters, or, historically, through the analysis of performance and reconfiguration of the environment. Real-time optimization is largely a product of how a solution is configured. Tranzax supports historic optimization through the use of a rich set of granular journal, trace, and audit data capabilities that are extracted by business analysts simply by configuring ViewPAKs using a drag and drop interface.

Tranzax provides a native simulation data set feature that allows real world configurations to be run against various complex data sets in a test environment without the physical connection of external systems. Tranzax does not provide a generalized statistical Monte Carlo simulator but runs real cases against simulated data sets that may be extracts of real world data or statistically generated sets.

### 4 Business Rules

Tranzax features a tightly integrated business rules engine that has immediate access to all data Elements and Case state information. Within procedures, business rules are supported through a Rule Step type to control branching and other automation actions. Each Rule step may contain one or hundreds of simple or complex nested business rules.

![Figure 7. Rules are configured within the Tranzax Workbench](image)

All rules are organized into a workbench folder named Logic PAKs. There are two fundamental types of Logic PAKs – Rule Sets and Result Sets. Rule Sets are comprised of collections of simple IF-THEN-
ELSE rules, which are combined into more complex logical structures to reflect the underlying business rules of the solution. There are six different types of Rule Set:

- Case Management Rule Sets are used to control requirement levels for Documents and Elements in a Case File (Optional, Required, or Unavailable).
- Common Rule Sets are used in other Rule Set types.
- Business Decision Rule Sets are used to control the selected transition from a Decision Step.
- Loop Control Rule Sets are used with Call Sub-Procedure Steps that have their Loop Control property set to "While Rule Package Returns True" or "Until Rule Package Returns True." The Loop Control Rule Set associated with the Call Sub-Procedure step is evaluated to determine whether to continue looping through the Sub-Procedure.
- Prerequisite Rule Sets are used to determine which versions of the Rules in some other Rule Set should or should not be evaluated for a given Case.
- Section Rule Sets are similar to Business Decision Rule Sets in that they are used to determine which transition to follow from a Make Decision Procedure step; they differ in that they are specifically meant for evaluating data in repeating Sections. The Section Rule Set will be evaluated against each instance of the repeating data in the Section, and will then combine those results to reach a single conclusion.

Rule Sets, when evaluated, produce an outcome, which must conform to one of the possible outcomes known as a Result Set. Every Rule Set is associated with some specific Result Set during configuration, and will take its possible outcomes from that Result Set; defining a Result Set is generally the first step in building a Rule Set. While each Rule Set has only one Result Set, a Result Set may be associated with many Rule Sets.

When all the If-Then-Else rules within a Rule Set have been executed, or fired, Tranzax applies a Result Set algorithm to generate the final result or action that is handed back to the object that called the rule. There are five types of Result Set:

- Action Result has actions as its outcomes, such as displaying a prompt or setting a Document status to “Required” – multiple actions can be specified for each outcome.
- Binary Result has the logical values True and False as its outcomes (might be Yes/No).
- Single Conclusion Result returns one item from a List of Values; each potential outcome is related to one specific value from the List.
- Compound Conclusion also produces items from a List of Values, but each possible outcome can consist of none, one, or several entries from the List.
- Score Result has as its outcome a number representing a calculated score value, such as an average, maximum, minimum, total, count, etc.

5 Integration

Tranzax reduces most external communication to well formed XML request and response documents. These documents can be presented in a number of forms over a number of transports. The most typical approach is a Web Service format, using SOAP over HTTP, HTTPS, or MQ. Inbound, unsolicited Web Service messages can bind to a published Tranzax Web Service and automatically initiate a designated Tranzax procedure.
Tranzax Document Sections may define data stored locally in Tranzax or point elsewhere to systems where the primary data store resides. Connection, caching, and updating policies for each Section are configured and associated with an XML Service. When such data is read or written, the XML Service will check the caching policy and, if needed, go and request the data or service.

Tranzax also supports an explicit External Service step type that, when executed, will send out an XML Service request and wait, using a range of policies, for a response. The actual mechanics of communicating with an external system are abstracted in a “Transport” component that will have been specially constructed for this purpose. All knowledge about the external system is contained in the Transport, external to the Tranzax environment. Tranzax simply creates a Request Document, calls the Transport, and (optionally) processes a Response Document sent back by the Transport. Tranzax has no knowledge of what the Transport does with the Request Document, or how it constructs the Response Document.

XML Services can optionally be marked as “Transactional.” If such an XML Service fails, a Rollback to the last commit point is performed and the calling procedure terminates. If the XML Service is non-Transactional, the calling Procedure will continue processing. Non-Transactional XML Services have an associated “Timeout” value that determines the maximum time Tranzax will wait for the Service to complete before considering it to have failed.

To “embed” the services of Tranzax into another application a Web Service is published that initiates a standard Tranzax automated procedure. Upon completion, the procedure will return an appropriate response to the Web Service.

6 Organizational Structure

Users are defined in a corporate LDAP directory or the native LDAP directory that ships with Tranzax. Each user in this directory is assigned to a group, which ultimately controls access to all aspects of Tranzax. Group authorization matrices are maintained via the Admin Console. The LDAP directory provides authentication services via JAAS. Single sign-on is supported. Security is multi-layered from system login right down to the individual case level.

Tranzax also supports the concept of users being “Workers” that can belong to any one of a number of “Teams” and can carry out a number of “Roles.” Workers can also have a range of user definable properties such as authorization level, training level, age, etc. that can define how work is processed and queued.

Roles define the user interface and functional access to the system. Roles define a list of valid interactive procedures available to a worker. These procedures can be started automatically either from a menu list or by selecting a specific Case to work on from a filtered search list.

Cases are queued to Workers based upon their Team, their Role, or other user-defined properties.

7 Process Adaptability

Tranzax provides an out-of-the-box case-handling environment. But the interpretation of case handling is subtly different from others we have come across to date. The key differentiating factor of a case-handling environment is the ability to run multiple procedures against a given case of work – the primacy is with the case rather than the process that is used to support a work item.

One approach to case handling is to leave it up to an empowered user to decide what processes are appropriate to bind to the case. With Tranzax, the developer has made all these decisions and has built a refined support environment for the user.
In a sense, Clear Technology has understood the needs of its target customers (back office and customer service operations for large businesses where the process model is relatively static) and has structured the case handling properties of their environment accordingly. The Tranzax approach to process automation is not designed for alteration at the case instance level or, in general, while the engine is in production. Changes to processes are more formally promoted via a test zone into production, and all runtime code is fully generated Java. Processing alternatives need to be designed in advance and achieved via case data parameters at runtime.

At the heart of the Tranzax case-handling approach is the clever conception of how data is integrated with business rules and procedures. Add to this, the unusual sophistication in the way that process sequencing and the waiting strategies for calling sub-procedures are handled, and the overall effect is a successful and scaleable case-handling environment.

8 Process Lifecycle

A Tranzax solution is developed following a work modeling methodology called ClearPATH. ClearPATH provides an organizing framework that supports the rapid development of Tranzax solutions in such a way that little or no analysis is required to support the configuration.

A Tranzax Environment is organized into any number of “Zones”: Configuration, Test or Training, and Production Zones. Versions of a Tranzax solution are “promoted” from Configuration to any one of the other zones. Promotion is the point at which all Tranzax Java code is generated and any custom code is compiled and packaged as a single deployable entity. All this is managed from the Eclipse-based Workbench.

Once a configuration is deployed into production, certain data elements may be locked from deletion or change to protect the integrity of the business data. A set of pre-requisite rules ensures that the correct version of business rules and procedures are applied to any given case instance.

9 Monitoring, Measurement, and Management Information

Tranzax ships with a centralized browser-based Administration Console that supports the Team Manager to manage Workers and Roles. Apart from this functionality, the developer can create a set of View PAKs using a drag and drop interface to report on work in the system (and completed work). View PAKs can access the three primary Tranzax data stores: configuration meta-data, active or archived case data, and historic audit trails of step and rule executions. View PAKs allow joining, filtering, and sorting of these stores to generate flat tables suitable for later analysis by 3rd party tools.

During production, all data changes are journaled and time stamped with the name of the human or automated entity that made the change. Tranzax also builds a complete audit trail of every step performed against a case instance showing, where relevant, the full business rule trees as executed with the actual data used to fire the rules.

10 Templates and Frameworks

Tranzax allows for configuration objects to be designated as “template” items. These constructs can be quickly re-used or extended to define a finished solution.

Clear Technology has developed a “Solution Framework” addressing the First Notice of Loss in P&C Insurance application. This solution also handles the subsequent claims process orchestration, and works in conjunction with existing policy and claims administration systems.
11 Vendor

Founded in 1998, Clear Technology is a privately held, venture-backed company, based in Westminster, Colorado. The firm employs 100 people and has 26 major customer projects completed or in progress.

12 Cost

Clear Technology separates the development license for Tranzax from the production license. A development license allows customers to develop and maintain applications only, with a one time perpetual fee charged at project initiation. The production license is determined based upon the size of the organization and the scope of the application. There are therefore different charges based upon whether the license is for a single process domain (e.g., Claims Recoveries), use anywhere in a business division (e.g., General Insurance), or right across an enterprise. The options for charging include:

- One time fee for a perpetual use license, with a 20% annual maintenance charge.
- A term license – an annual fee for 3 years usage, with the license renegotiated at the end of the term.
- An annual recurring license – flat fee per year.
- A transaction based license fee – payable monthly, based on some agreed upon parameter (e.g., policies processes, claims processed).

Entry level pricing is of the order of $100,000.

Services are charged either on a fixed price basis services delivered for a defined project or on a Time & Materials basis. A typical project, right through to production, might involve a team of 5 consultants from Clear Technology for 6-8 months.

In addition to the above models for License and Services, Clear Technology is prepared to consider risk reward type deals, where some costs are paid up front to cover the costs of developing the automation application, but Clear takes a percentage of the benefit stream on an ongoing basis.
TRAXION Enterprise Business Process Management Suite

Version: 7.2.2

CommerceQuest Inc.
5481 West Waters Avenue, Suite 100, Tampa, FL, 33634
Tel: 813-639-6300 Fax: 813-639-6900
Web: www.commercequest.com Email: analyst@commercequest.com

1 Product Overview

CommerceQuest’s TRAXION Enterprise Business Process Management Suite (TRAXION) provides an end-to-end solution comprised of two distinct, yet integrated product sets – the Business Innovation Xcelerator and the Business Integration Xcelerator. The Business Innovation Xcelerator provides modeling, design, analysis, execution, integration, management, and monitoring capabilities. The Business Integration Xcelerator is used to build and integrate system-to-system, composite application and services oriented solutions. On top of this combination, CommerceQuest also provides a number of QuikTrax Process Accelerators. QuikTrax Process Accelerators are complete process enabled vertical applications that allow customers to take a fast track to implementation, yet allow forwards extensibility and enhancement (complete list in final section).

![Diagram of TRAXION Environment](image)

Figure 1. The CQ environment is composed of two distinct applications that can be purchased separately or together

The Integration Xcelerator is focused squarely on the needs of Enterprise Application Integration, whereas the Innovation Xcelerator is primarily oriented towards the needs of humans and the collaborative processes in which they are involved. These two products can be purchased as stand-alone components or tightly integrated to support the wider needs of a BPM initiative. For the purposes of this report, we will consider the Integration Xcelerator within the Integration section. Key differentiating features of the TRAXION environment include its support for CICS integration into the wider business process. The Integration Xcelerator includes a specialist component that allows the business to introspect and reuse any CICS application, making its core functionality available to the wider business process (without having to redevelop the CICS application). Secondly, TRAXION also has a unique J2ME mobile interface that supports offline operation, synchronizing on connection.
2 BPM Engine

The Business Innovation Xcelerator’s process execution component, the Process Execution Manager, is a J2EE-based application that runs inside industry standard Application Servers, including Apache Tomcat, BEA WebLogic, and IBM WebSphere Application Server. It is responsible for monitoring and controlling all business processes, and orchestrating events within and across multiple processes. The core framework is process-centric and component-based. It is built on a multi-platform and language neutral Service Oriented Architecture (SOA) that operates on top of any JMS compliant transactional Enterprise Service Bus (ESB).

Process models are stored in an XML format (based on an extended set of XPDL) and are based on a mix of Procedural information and data from the Resource Modeler. The Process Execution Manager (PEM) parses and reads the XML instructions, and the various runtime elements in the PEM then rely on these instructions:

- **Task Scheduler** – creates Activities that are carried out by employees and other resources.
- **Agent Scheduler** – handles interactions with third party applications.
- **Milestone Scheduler** – tracks process instances against milestones set in the process model. This is a relatively unusual capability in BPM support environments.
- **User Interface** – for administration of task lists and administrative detail.
- **Reporting, Charting and Dashboard**

The Process Execution Manager can use either its own file-based repository, or, when a customer uses the iGrafx business process analysis tool, it can utilize the iGrafx Process Central Repository as the storage mechanism. Both the file-based and iGrafx repositories import LDAP and active directory structures to specify security access to repository files for different groups and roles.

The Resource Modeler is designed to reflect the overall operating environment of the business process, including all people, organizational forms, roles, application level resources, system resources, etc. Where integration is required with third party applications, the Process Execution Manager uses a Process Manager Agent to pass contextual information (in an XML format) to the application and then return the result. Process Manager Agents are reusable components that are represented via the Process Resource Modeler (they are regarded as a special type of resource required to execute the process). If needed, more sophisticated Process Manager Agents are available through the Integration Xcelerator.
CommerceQuest provides its own modeling environment, along with two-way integration of the iGrafx modeling environment and, rather unusually, the Mindjet Mind Mapping product, MindManager. Future plans include integration with other 3rd party Business Process Analysis tools.

Once a process model is completed in the modeler of choice, it is imported into the PEM. Within the PEM, there are various ways to interface with an executing process, including SMTP (email), Mobile interfaces (TRAXION mobile), Web Services, JMS messages, Java agents, as well as the usual browser-based interface.

The mobile interface is a J2ME application that is capable of stand-alone operation (i.e., without connection to the server), synchronizing when communication is available. In effect, this allows the resulting application to be smeared across the network. The user need not worry where the data is stored; as far as they are concerned, it is available when needed.

All data generated about process instances, such as completion of task, notes about the task, time and cost metrics, etc., is stored in a relational database for near-real-time and historical reporting purposes. This information is then consumed by the TRAXION Business Activity Monitoring (BAM) and reporting/dashboard capabilities, or by third party Business Intelligence and/or other BAM products.

Within TRAXION, Web Services can be used to support integration of third party applications and publish/invoke processes and subprocesses.

2.1 Platforms

CommerceQuest supports all major technology platforms, including mainframe, AS/400, UNIX, Tandem, Windows, and Linux. TRAXION uses standard relational databases (DB2, UDB, Oracle, SQL Server, Informix, and any JDBC accessible database) to store the executable versions of the process.

2.2 User Interface

Most users would use the browser-based interface to access tasks assigned to them, track projects, track the status of a case, or monitor the status of the overall process through dashboards and reports. Out-of-the-box user interface functionality is relatively standard, based around tabular views of work to which the individual has access. Other customizable views include bundled BAM functionality and the ability to search for cases of work and drill down on their status. TRAXION supports DHTML and has integration options available for Plumtree and IBM's portal. The next release will support JSR 168.

2.3 Scalability

Scalability is primarily addressed through the ability to load balance and provide fail-over facilities provided by the J2EE Application Server. Apart from these capabilities, TRAXION achieves scalability through the ability to share work items through work queues (that are shared between systems and processes), thereby enabling parallel processing or load sharing. Secondly, work items can be automatically escalated or re-assigned to alternative resources (human and system) if an initial resource is not responding within given performance criteria.

Work queues can be networked reliably (via WebSphere MQ) to distribute the load or move work items to remote or distributed systems. WebSphere MQ Cluster also provides load balancing for system processes and tasks. Moreover, the asynchronous messaging nature of WebSphere MQ allows queuing of tasks when systems or people are off line.

Coordinators (in the Business Integration Xcelerator) achieve built-in reliability through the messaging systems and are optimized for performance on difficult platforms, such as the mainframe or the AS/400. The Coordinator is a stateless, event driven process flow controller, which is activated by the arrival of XML formatted messages via any transactional JMS compliant ESB (Enterprise Service Bus). Because of its stateless design, a single instance of the Coordinator can manage multiple concurrent
micro-flows, and multiple instances of the Coordinator can dynamically be started by a higher level dispatch manager, based on load and performance requirements.

On the Windows platform, the Coordinator uses specialized meta-data to represent the interface definitions, dynamically interfacing with any external components such as COM/DCOM, .Net, EJBs, MDBs, and Web Services. The Coordinator dynamically calls these interfaces to properly marshal the Business Objects to and from the component interfaces. Coordinators interoperate and can be configured to run either in central or distributed locations, depending on workload or various operational requirements. All Coordinators are managed via the Java Management Extensions (JMX) API's.

3 Processing Modeling

![Figure 3. The Process Flow Modeler](image)

The human interaction development environment is housed in the Business Innovation Xcelerator and consists of the Process Flow Modeler and the Process Resource Modeler. (See Figure 3 The Process Resource Modeler is a tool for mapping the organization's reporting structure, its roles, and all its resources. It is based around an n-dimensional resource modeling tool that enables the PEM to assign process tasks based on any combination of attributes (dynamic role, time available, rank, certification, skill level, etc.). This Resource Cube dynamically locates the best possible resource, person, or workgroup for tasks, rather than assigning them directly to a particular person, resource, or static role.

![Figure 4. Tasks can be configured to dynamically establish routing to the best possible resource at runtime (ResourceCube)](image)
Any resource outside of the organization can also be represented in the Process Resource Modeler. These external resources can represent a person, an organization, a Web Service, an application, materials, etc. This resource is then given properties such as time availability and costs.

The Process Flow Modeler is used to reflect the core tasks and dependencies of the business process. Further information is captured on expected effort, duration, cost, and any other relevant resources (stand-in, automatic escalation parameters, etc.). Task-based instructions are also added (check lists).

TRAXION supports the importing of process models where any third party modeling environment that saves its process definitions as XML is a candidate for importing into the PEM. Customers can choose the iGrafx modeling tool set as alternative to the Process Flow Modeler. Process flows are then designed using custom-defined templates or methodology-specific modelers such as Rummler-Brache, IDEF0, UML, Cause & Effect (Fishbone), BPMN, and Lean Value Stream Map notations.

Unique to CommerceQuest is a two-way interface for MindJet MindManager. Process Flow Modeler can also import MS Project Plans (.mpp), including all major tasks, subtasks, task assignments (resources), duration, effort, cost, etc. Future plans include integration of other 3rd party BPA tools.

3.1 Subprocesses

TRAXION supports the creation of process hierarchies that include processes and subprocesses. Subprocesses are either linked or embedded within the hierarchy. Generally speaking, subprocesses stand alone and are called by the parent process at runtime. Subprocesses can be invoked in either a synchronous fashion (triggered) or asynchronously (spawned). TRAXION also supports the synchronization of two or more processes (rendezvous). Processes can also be suspended and resumed.

3.2 Shared Data Space

As long as the existing information is in some accessible form, it might be in a modeling repository for instance, then accessing it from within TRAXION to establish the SDS is trivial. Developers can, of course, create variables one at a time into the XML structure of the process definition. Arrays are supported. Importing the structure from, say, a WSDL source or any XML structure is relatively straightforward using something like XMLSpy, or using XSLT tools. CommerceQuest also has tools for importing existing COBOL applications.

3.3 Forms

Any third party forms package that generates Java Servlet Pages (JSP’s) can be used.

3.4 Time

All tasks in a process model are populated with due-date information and deadlines for tasks to be claimed once placed in a queue. Automatic priority elevation and escalation of tasks is then based on this information. Alerts generated may include task delays, exceeded thresholds, cost overrun, down systems, etc. The delivery options include email, pager, and mobile devices.

3.5 Process Optimization & Simulation

TRAXION incorporates a pre-production simulation capability that can help the business optimize processes using what if scenarios and other analysis tools to identify improvement opportunities, before that process is ever deployed. This tool supports CommerceQuest’s BPM methodology and helps identify inadequate process resource allocations. The simulation environment leverages the rich information gathered in the Resource Modeler to build a robust picture of the interaction between sets of processes and the resources they leverage. Most other simulation tools focus purely on one process at a time. The approach taken by TRAXION provides a more realistic picture of the impact of changes and the true value on investment returns for the business. Note this facility is designed for process developers rather than for extensive use by end-user managers.
4 Business Rules

Apart from the constraint-based business rules associated with the flow of the process, TRAXION supports the integration of the third party Corticon BRE via Web Services calls. One could also argue that the use of the ResourceCube allows advanced resource allocation and routing rules to be implemented.

5 Integration

The Business Integration Xcelerator provides sophisticated integration capabilities and, in its stand-alone form, is targeted at the needs of IT organizations undertaking EAI style systems initiatives. The Integration Xcelerator can also be tightly coupled with the collaborative business process oriented Business Innovation Xcelerator to provide exhaustive capabilities for third party applications linked into human-centric processes.

For less complex integration needs, a simpler and more accessible approach using Web Services as the integration approach is also available within the Business Innovation Xcelerator. It can act as either a requester or a provider of Web Services anywhere within a process. Moreover, any existing Java program or logic can be directly invoked as an agent to become part of the business process. It also supports JDBC, allowing direct access to relational databases.

Within the Business Integration Xcelerator, CommerceQuest provides an integration toolkit (based in either the Eclipse Workbench for Java programmers or Visual Studio .Net for Microsoft shops) that is rich with APIs and scripting facilities to handle any integration challenge. UML and MDA methodologies can be leveraged by the application suite. It can seamlessly integrate with third party applications in a variety of ways (including Web Services) via Messaging (WebSphereMQ, JMS) – through packaged enterprise applications adapters (partnership with iWay); through horizontal-technology adapters (from providers such as IBM, SeeBeyond, webMethods, TIBCO, Jacada, etc.); and through its own Process Manager technology.

TRAXION also enables developers to introspect (dynamically discover) and componentize functionality from third party and legacy applications. Programming models supported include C, C++, COM, ActiveX, Java EJBs, COBOL, etc. Additionally, this type of functionality can do the same for data stores such as VSAM, IMS, DB2/MVS, DB2/UDB, Oracle, SQL Server, Sybase, Informix, etc.

The Business Integration Xcelerator modeler can also import existing UML diagrams, which can then be used to define micro-flows in system level processes. Effectively, this delivers the capability to create composite applications – assembling parts of a system-level process into a larger, more manageable component (subprocess) that can then be integrated into other business processes where they are monitored and managed within context.

As we outlined earlier, the Business Integration Xcelerator includes a unique capability – to tightly integrate with CICS applications. (See Figure 5.) Through the implementation of a bespoke component that sits within the CICS TP environment, any bespoke CICS functionality can be introspected and componentized. This should be of interest to mainframe shops that have a mass of CICS legacy applications that they wish to reuse in modern BPM implementations.

Within the Business Integration Xcelerator, CommerceQuest utilizes a separate process orchestration engine (the Coordinator) to manage micro-flows. This component serves as an abstraction layer to separate the logical application layers such as presentation, data access, and business rules processing. Business objects are instantiated and transformed within the Coordinator, as required, to support system level integrations. These system level integrations are represented as agents in the overall process executed in the Business Innovation Xcelerator’s PEM.
6 Organizational Structure

Within TRAXION, the Process Resource Modeler's ResourceCube is used to reflect the structure of the business. This multi-dimensional modeling tool makes it possible to assign process tasks based on any combination of attributes (dynamic role, time available, rank, certification, skill level, etc.), rather than assigning them to a particular person, resource, or even a static role.

![Resource Modeler Diagram]

Figure 5. The Resource Modeler is used to build rich models of the reporting structures in the organization and the workgroups that exist within it (along with all other resources).

Users are set up either manually through the Process Resource Modeler, or imported from the LDAP Directory Server and updated periodically. This information is maintained via the Process Resource Modeler, which may then be uploaded into the LDAP directory. We understand that the next version of the product will directly reuse the facilities of the LDAP Directory Server.

At runtime, the PEM uses the ResourceCube to automatically find the best possible resource, person, or workgroup for a task. If no resource is available, it will find the next best resource, or substitute resource, until the task is assigned and accounted for. Substitute resources are automatically located if that primary or designated resource is currently unavailable (person on vacation, system in state of overcapacity, etc.). Assignments can be delegated to other users either manually or automatically.

7 Process Adaptability

The process models of existing cases of work can be changed, and the tasks can be suspended, delegated, or re-allocated to alternative resources. When importing a new version, it can be set to only affect new cases as they are instantiated. Alternatively, it can be set to override an existing definition, affecting all current instances of the process. Finally, it is possible to selectively update the process model for cases already in existence. Multiple versions of the same process can also execute simultaneously.

8 Process Lifecycle Management

When the iGrafx modeling environment is used in conjunction with TRAXION, the system uses the Process Central Repository from iGrafx to support version control. Version control is automatically maintained as users check in and check out repository files. Each check-in produces a new document version. Process Central maintains unlimited back versions and a detailed history/audit report of each repository file. The history includes author name, comment, and revision date of current and prior versions. iGrafx audit functionality includes the ability to view older versions. In addition, changed documents are optionally forwarded to associates for review and approval. When a colleague approves a change, his or her action becomes part of the document record and audit trail.
The Process Central tree control shows all process dependencies and interactions. For example, shared processes are clearly identified and all parent processes are listed under the shared process name. Process map links to non-iGrafx documents are also displayed under the process name. If a linked document (e.g., a MS Word document) is moved or its name is changed within a repository, then Process Central updates and fixes all parent process map links. When using the TRAXION process-modeling environment, CommerceQuest uses a file-based repository to manage version control.

9 Monitoring, Measurement, and Management Information

One of the differentiating points of the TRAXION environment is the ability to identify process milestones – checkpoints in the process that have predefined due dates that should not be missed. If a milestone has not been met, i.e., the milestone task has not been completed on time, then the TRAXION event handler can take some action. This might be as simple as sending the process supervisor an email notification and flagging an alert on a dashboard. Alternatively, a new process or subprocess might be kicked off. The system also includes the capability to aggregate data across cases.

Figure 6. Dashboard capabilities are incorporated into the standard web browser client

In common with virtually all other BPM systems, TRAXION captures comprehensive process audit information that is stored within an associated relational database. This information is then available for presentation using the integrated Business Process Monitoring capabilities or other third party Business Activity Monitoring (BAM).

Figure 7. Performance metrics are provided at both the process and business level

Process and project metrics collected over an extended period of time can be used to continuously improve the project/process. Graphical representation of real-time data is provided through charts, reports, and alerts, including access to audit information and transactional data. Quick status updates provide for both business processes and the system integration that supports the process.
The CommerceQuest approach monitors actual effort, duration, and cost of each task and overall project/process, which then drive TRAXION's own Business Process Monitoring dashboards, reports, and audit sub-systems. Using the dashboard facility built into the web browser client, executives, supervisors and managers get a high level overview of the performance of all processes/projects and their business metrics. This also incorporates the ability to drill down to identify problems and provide corrective action.

The dashboard servlet displays a configurable variety of context-based (information about the process) and content-based (information generated in the process) reports. It runs inside of the J2EE application server and leverages the role-based security of the overall TRAXION environment.

Each QuikTrax Process Accelerator provides tailored dashboards specific to their subject domain and custom processes.

10 Templates and Frameworks

CommerceQuest’s QuikTrax Process Accelerators are a key component of their overall business process management solution. Think of QuikTrax Process Accelerators as industry templates and applications that span key operational and risk management processes. These prepackaged applications are based around robust sets of vertical and horizontal process models, resource models, business rules, roles, and commonly used integration components. They allow for faster implementation and deployment times and help ensure dramatic improvements in process performance and ROI.

QuikTrax Process Accelerators are available in the following areas:

- Commercial Financial Management – a wide variety of Accounts Receivable options customized to different verticals such as Professional Services and Product suppliers.
- Healthcare – Clinic Patient Scheduling, Hospital Admissions.
- Human Resources – Employment (Hiring), Performance Review Management, Training Administration, Benefits Administration.
- Insurance – Claims Management.
- Supply Chain Integration – Product Lifecycle Management, Product Development Programs, Import Sourcing Management, Vendor Management, Distribution Center Optimization, Customer Programs, Chargeback Administration, CRM, Inventory Optimization, Quality Control, RMA / DMR Control, Inventory Tracking, New Assembly Component Sourcing, ECO / ECN Control, CPFR Administration.
- IT Management – Patch Management
11 Vendor

Founded in 1991, CommerceQuest is a privately held venture-backed company employing around 110 people. Its annual revenues are around $20-$30 million from around 500 customers with approximately 75% of that revenue deriving in the US. The remainder is focused on Europe with an increasing presence in South Africa and Asia Pacific regions. Vertical market specialization is around Retail, Financial Services, and Government applications (indeed, a wide range of applications are directly supported in these areas).

12 Cost

CommerceQuest uses a relatively unusual model based on a Concurrent Process License. This is calculated as the Number of Users x Number of Processes. A User is defined as: (a) a human user allocated to a specific process or (b) a system interface used by a specific process. If a user (human or system interface) is allocated to work on multiple processes, the user needs to be counted with each process. However, a subprocess within a process does not count as an additional process.

For analysis, modeling, simulation, and process execution, an entry-level package is $75,000. This will provide 5 Process Modelers, 5 Resource Modelers, Simulation capability, and a test Process Execution Manager (PEM). This package provides all of the necessary design elements and a test environment. A production Process Execution Manager is $45,000 with 50 CPLs. Each additional 500 CPLs is a further $25,000. Price bands are based on additional CPL packs that may be required in addition to the CPLs included with the Process Execution Manager.

The Business Integration Xcelerator pricing, depending on the platform and integration requirements, would range from $75,000-250,000 and upwards. Enterprise License Agreements (ELAs) are also available. Maintenance of between 17-20% is also charged.
1 Product Overview

eg work manager® (from here on referred to as eg work manager) is a Business Operations Management (BOM) package that supports and coordinates the management of work, resources, and performance measurement. It provides intimate support for the eg principles of production management®, a fully developed operations management methodology that integrates the management of work with the supporting organizational resources and necessary skill competencies. This is delivered with mature Quality and Compliance modules that automate sampling (for audit purposes) and track related Customer Events. Alongside that, eg work manager provides sophisticated capabilities in performance forecasting services, progress monitoring, and historical reporting.

The product concentrates on the needs of managers running teams of people, helping them ensure that they continuously improve productivity. Effectively, eg work manager accepts work from any third party source, including major BPM engines (a bundled engine is available, if needed), or work can be entered into it as the primary receptor. It applies a tightly integrated set of business rules for how that work is to be prioritized and assigned to individuals, taking into account the available resources, varying skill levels and efficiency, and service level and performance objectives. eg work manager also provides critical support for firms’ quality and compliance objectives, automatically supporting the enforcement of regulatory controls and gathering the evidence to support compliance submissions.

eg work manager can be used as a stand-alone package, and/or linked to Line of Business (LOB) systems, and/or integrated with other BPM applications. Either way, it is designed to provide effective management information for a wide range of audiences, from Team Leaders to Senior Executives. eg work manager provides a single integrated view of all work, monitoring items from any source – paper, telephone calls, BPM engine, e-mail, and so on – to provide an integrated approach to work and resource management. As a result of this coordination, all work is managed, tracked, and reported on, enabling an optimal utilization of available resources.

eg work manager combines a wide range of generic and custom Key Performance Indicators (KPIs), measures, and management information into one system, providing a clear indication of the impact that a change in one measure (e.g., staff skills) has upon another (e.g., customer service). It provides real-time and automatic management information at any level – by individual, team, department, division, location, process, channel, or customer group – across any time frame – hourly, daily, weekly, monthly, yearly; past, present, or future. eg work manager links IT and business operations to the delivery of these KPIs.

Immediate and measurable performance improvements derive from employing the system as part of a proactive management discipline. When customers use the product and packaged performance improvement methodology, eg solutions are able to guarantee productivity improvements (minimum ROI in 12 months) with cost reductions of 15-50% achieved within 4-6 months. This is a true USP in this market. Customers typically describe productivity improvements in excess of 20%, over and above that achieved through the introduction of a BPM engine. Moreover, customers also point to the ability of the methodology and product to support a fundamental change in the culture of the organization.
Critical components of the Production Management methodology include accurate capacity planning, short interval scheduling of resources against work, and load balancing of the available resources. The production management methodology underpins the development of a detailed understanding of the precise information required for work, resource, and performance management, based on effective management information. It acts as the basis for all Team Leader and Operations Management development, providing them with the underlying skills required to manage people and processes in an integrated way, achieving high quality delivery and fast customer service while, at the same time, reducing unit costs. The methodology is based on a sophisticated knowledge of business processes and the factors that affect their performance.

2 BPM Engine

As outlined in Figure 1, the functionality of eg work manager is spread across several areas. Where needed, it integrates with external BPM Engines or other LOB Applications. (A bundled BPM Engine is also available.) However, the primary focus is on Business Operations Management (BOM). This enables the firm to integrate business processes, resources, and customer requirements holistically to underpin achievement of business driven KPIs, and then to monitor them on an ongoing basis with the aim of improving organizational performance. BOM functionality encompasses the following:

- **Production Management** represents the proprietary methodology that underpins the technology components. It is primarily designed to provide knowledge and skills for first level managers/team managers in how to use the various tools and reporting mechanisms to get the most out of their people, processes, and technology. The **eg Principles Of Production Management** is a 7 step method encompassing Measurement, Planning, Communication, Allocation, Monitoring, Analysis, and ongoing Improvement disciplines.

- **Work Management** is a component that calculates how work is deployed to the human resources involved in the process. The focus here is on work distribution, leveraging the established operational rules to ensure resource availability/expertise, service standards, and prioritization. eg work manager not only uses the rules stored in the organizational directory server (on skills, team membership, etc), it also captures and then leverages how well individuals carry out their work. It also factors in information on the customer/channel and product.

- **Resource Management** is where the structure, skills, and competencies of the organization are modeled and reflected. The Resource Management component reflects the formal reporting
structures of the organization and of any work groups, teams, or matrix structures, as well as the skills of individuals.

- **Performance Management** provides the management information necessary to monitor the performance of the organization at many levels – individual, team, department, whole business function – or even summarizing performance across disparate locations. Performance can also be summarized by process or customer group to support process improvement or customer focused performance management.

- **Quality Functionality** is used to define exactly how Quality is delivered and how it is recognized. The product supports any number of Quality checks, whether at Process Start, In Process, or End-Of Process, linked to sampling rules based on individual resource skill competencies and past performance or compliance requirements. It also includes the automated sampling mechanisms required to support this functionality.

- **Compliance** focuses on ensuring that work items are distributed to suitably qualified and trained members of staff (important to Financial Services firms). Managers also establish sampling criteria for Compliance purposes. Sampling often involves collecting additional contextual data from other LOB applications, third party BPM engines, or call center applications. A full audit trail for Compliance Reports is automatically generated with evidence gathered in real-time.

- **Customer Event Management** capabilities support the capture and tracking of customer requirements for a given type or work or individual case. When integrated with the rest of the suite, it enables a highly refined approach to customer relationship management.

- **eg operational intelligence™** provides forecasting and prediction services, as well as the consolidation of management information into higher level reports, supported by OLAP style data warehousing. It also includes a variety of Performance Dashboards to support managers as they track their defined KPIs, customers, individual processes, and activities across the organization and at any level of abstraction.

Figure 2. The underlying technology architecture of eg work manager is centered on a core database application

### 2.1 Platforms

The servers supported are NT4 and Windows 2003, with SQL Server 7.0 & SQL Server 2000.
2.2 User Interface

ASP.NET-based user interface is used for system set-up and reporting (management information for team leaders and managers). A set of dashboards and an extensible set of reports are also provided.

![Figure 3. Work allocation takes into account resource skill levels and work already assigned](image)

2.3 Scalability

Based on a recent benchmarking test, eg work manager proved scalability to 6000+ users on a single 16-way Intel box. Typically, it will support up to 2000 users per SQL database for both the system and web-based operational intelligence modules.

3 Processing Modeling

When integrated with an external BPM Engine, process steps are imported from that system. However, if operating in stand-alone mode, or integrated with a LOB application, steps are defined directly in the eg work manager database. Processes are modeled at the task level to support reuse in other processes. This approach provides for consistency in the process model as well as allowing for best practice comparisons.

3.1 Subprocesses

When reporting on processes, the product supports nested subprocesses.

3.2 Shared Data Space

eg work manager is not concerned with the underlying data structure of the application; the SDS of the process is inherited from the process engine.

3.3 Forms

eg work manager does not concern itself with the eventual user application – that is still delivered via the third party BPM engine or LOB application. The forms that are used by the product are designed to support the BOM functionality delivered.

3.4 Time

Time is used in many ways. Clearly, Activities (tasks) have allocation times set against them for how long things should take, and set benchmarks for the typical elapsed time required to process a case. Turnaround times can be set to measure the time from initial receipt of the case or from completion of the previous task. Time is also used to support service definition and work allocation cycles for
employees. (In the production management discipline, short interval scheduling is used to drive productivity.)

From a reporting point of view, these targets are then used to calculate achievement against previously established SLAs. Across the system, time may be set from minutes to calendar years, or within a specific date range.

### 3.5 Process Optimization & Simulation

The core eg work manager system does not include any simulation capabilities in the strict interpretation of the term. Instead, it focuses on optimizing existing processes based on clearly stated operational rules and knowledge of how much work is in the system, building a realistic picture of work to do and work in progress. eg work manager then delivers a sophisticated planning capability to calculate the amount of work in the pipeline and the resources required to carry it out if the firm is to meet customer requirements. Alternatively, given a current workforce, it can calculate how much a team or organizational unit can realistically handle. A separate forecasting module allows the business to simulate the impact of change and plan accordingly.

### 4 Business Rules

In one sense, eg work manager is a focused business rules engine. Rather than attempting to offer generic extensible rules capabilities, the product delivers a custom set of business rules that work together to drive the effective operations of the business. In eg work manager, business rules are really operational rules and involve setting standards for customer service (i.e., turnaround times), quality, resources (availability and skills), as well as time. And, of course, it provides capabilities to refine those rules to suit the needs of individual firms.

From a work allocation point of view, rules are used to define (re-assign) work to the most appropriate employee. When establishing definitions of quality and compliance, one is developing rules about how those concepts are interpreted in the business. Rules are used to expose information to managers (at different levels of the business), to provide them with relevant performance metrics on the processes and teams under their control.

### 5 Integration

eg work manager is relatively agnostic with regard to integration. As it is not delivering the end-user application, it is really an issue for the third party BPM engine or LOB applications. In terms of picking up and gathering information from third party work sources, it uses either a message queue type infrastructure (MQ Series), Web Services, or the native API of that external application. (See Figure 4.)

When integrated into the business process systems architecture of an organization, eg work manager gathers items of work from external sources (via XML messages over Web Services or MQ), applies the established set of rules to the work (to define/re-assign who/when, etc.) and then passes work back to that third party environment for it to be carried out. When completed, the external application posts a message back to eg work manager. From the work management at the runtime point of view, eg work manager refines the relatively crude work allocation routines of major BPM engines to support shades of grey, leveraging a more accurate representation of how well work is done alongside the skills and competencies of the employees.

All of the core business and data logic is encapsulated in stored procedures in the database. Integration Services consume and distribute messages from and to other applications via pre-defined XML message formats. Alternatively, third party applications are integrated directly via their API set. Management Information and Operational Intelligence capabilities are delivered via the ASP.NET user interface. Along with the ASP.NET user interface, a thick client version is also available.
By its very nature, eg work manager is highly data intensive. At the moment, the product is available, based on SQL Server, although an Oracle version could be made available (depending on customer demand). The supporting database structure contains two types of schema – OLTP and OLAP – reflecting the two sides of the product, work distribution and reporting.

Figure 4. eg work manager integrates with external LOB applications and BPM Engines

6 Organizational Structure

eg work manager builds on top of any existing investments in Directory Services via LDAP or Active Directory. Against each individual, the business will need to build up an accurate picture of their skills and competencies. eg work manager itself also tracks and calculates how well individuals carry out their work (based on quality metrics). As part of the eg methodology, individual skill development is tracked and supported.

7 Process Adaptability

eg work manager is not concerned with the structure of the process and, as such, is agnostic to the nature of tasks being delivered by external BPM Engines or LOB applications. Where necessary, work can be allocated to alternative resources to help load-balance the organization.

8 Processes Lifecycle

eg work manager and BOM is primarily focused on the lifecycle management of the process in the context of all the operational factors that affect its performance. The product enables firms to see more clearly how their processes perform under load conditions (i.e., it is not how a process looks when mapped that is important, but how it performs in terms of service, quality, and cost). When processes are more effectively managed, using eg work manager, end-to-end service times are normally dramatically reduced and accuracy increased.

The focus of the product is not on the lifecycle management of the process object itself, although that is still important. eg work manager is all about the management of the people who work within the process.
– what their collective efforts can achieve, where they are struggling, how much work is in the pipeline, and what they have to get out the door today, tomorrow, this week, or by the end of the month.

9  Monitoring, Measurement, and Management Information

Work in the system is monitored and measured in real time. eg work manager stores that data in order to provide effective management reporting as needed at the time (rather than on a purely historical basis).

Management Information for team managers is delivered to the user by a suite of dedicated reports that are designed to deliver the correct level of detail to each type of end-user, eliminating information overload and the necessity to continually generate ad-hoc reports (common in most management information solutions). The separate Operational Intelligence capabilities also provide for user customization, with slice and dice capabilities and enhanced export facilities (e.g., to Microsoft Excel). Information can also be delivered to other high-end business intelligence applications using Integration Services to distribute XML formatted messages.

10 Templates and Frameworks

No application templates are provided. One could think of the entire product as a sophisticated framework for the management of work, resources, and performance.

11 Vendor

eg Solutions Limited is a privately owned company based in the UK. Formed in 1988, the firm has focused on the financial services industry offering pragmatic services and products that improve Operations Management using, Production Management, and Continuous Improvement methodologies. eg Solutions is the largest firm specializing in BOM tools. Based in the UK, the company has clients in
the UK, Europe, Middle East, and India. As a product, eg work manager is used in over 20 major financial services institutions by around 20,000 people.

12 Cost

The eg pricing model is based on the numbers of licensed users and implementation fees related to the methodology. A user is a named member of the staff involved in the processing of work (i.e., every individual for whom performance data is held). Implementation fees are based on the extent of Production Management skills/knowledge that already exists and the work involved in establishing the appropriate disciplines.

eg provides a fixed cost quotation based on an upfront on-site assessment that is conducted on a free of charge basis (depending upon the scale of the assessment, there may be some cost if a more extensive assessment is required). The company aims to provide a 2:1 ROI within 12 months (as a minimum), although this can be difficult in clients of less than 250 users where the ROI is usually around 1:1 in 12 months. Over 1000 users, the ROI can increase exponentially where 4 or 5:1 is typical.

With each customer engagement, eg Solutions guarantees to achieve certain levels of benefit and defers a percentage of its fees pending satisfactory delivery. The benefits to be achieved are identified during the assessment and agreed upon with the client during the contracting stage.
1 Product Overview

The FileNet flavor of BPM combines notions of Process with Active Content management. This combination enables a wide variety of process management scenarios. Active Content can represent literally anything that is of interest to the business – from unstructured documents through to LOB applications and customer cases.

At the core of the whole environment is a publish and subscribe event based model. As Business Objects in the repository change state (i.e., as they are created, modified, or deleted), the system automatically launches the appropriate process or interaction with an existing process. For example, once a mortgage application is created, the process for managing that application instance is immediately created and executed. If the mortgage were subsequently modified (say, by raising the amount to be borrowed), then this event would automatically invoke the appropriate review processes, as required.

This event-based thinking permeates the whole environment: Events might be driven by transactions in LOB applications, or could result from another process being completed, or even by a user selecting a particular option. Of course, users (or groups of users) can subscribe to events that might then drive them towards specific tasks or dynamically update the status of work in the Tracker interface.

If thought about properly, this event driven approach can significantly minimize the total cost of ownership for process enabled applications. If you add to that the ability to publish and consume Web Services supporting firms’ SOA and composite application development initiatives, the overall environment can deliver highly flexible and adaptable process architectures, while also reducing overall development time. Of particular interest is the way in which the product easily supports the construction of effective case handling environments. (See Process Adaptability).

The product benefits from a tightly integrated business analytics and simulation capability aimed at business analysts and managers. This technology is used to support FileNet's vision of round-trip re-engineering – modeling, analyzing, simulating, and deploying processes to optimize them on a continuous basis.

Having a reliable method to link changes in business processes to changes in content provides a more realistic chance of ensuring regulatory compliance. Moreover, if thought about carefully at the process architecture level, the event-driven content approach allows firms to develop customer self-management and pro-active relationship management applications – for example, alerting a bank customer that their account will soon go overdrawn.

2 BPM Engine

Business Process Manager 3.0 (FileNet BPM) is based on the FileNet P8 Platform Architecture, which includes FileNet’s 6th generation of process technology, in addition to providing a fully integrated Content Management engine. As such, it benefits from a rich legacy of process thinking and an extensive array of capabilities.
Underpinning the FileNet Business Process Manager architecture is the P8 Engine, which is made up of a number of components that exist within distinct layers of functionality:

- **Presentation Layer** – runs in the web application server (BEA, IBM, etc.). Functionality delivered at this level includes Workplace, eForms, Records Manager, Team Collaboration Manager, Content Provider, and Portal Integration.

- **Business Logic** – provides a higher-level abstraction with a logical business or application grouping of functionality delivered over and above the Java and COM APIs into the Services Layer engines. This layer also contains the Records Manager Services and the Component Integrator, which is part of the functionality of the Process Engine (packaged as part of the BPM suite).

- **Services Layer** – contains the main engines: Content Engine, Process Engine, Rules Engine and Image Services. Notice the Web Service Interface that provides another touch point into the Process and Content Engines (besides the COM and Java APIs). This layer also contains the underlying capabilities of the Process Analyzer, Process Simulator, and Integration.

- **Data Layer** – shows interfaces with existing business/legacy applications. It also shows connectivity to an LDAP Server for authentication and authorization.

Figure 1. The major components of the underlying P8 Engine, bringing together process with content and LOB applications

The Content Engine is the core repository where virtually all items of interest are stored and managed as a series of Business Objects. It also manages process definitions (stored as XML documents) and related information on items of work in the system. Focusing on Business Objects (and their state) allows the environment to directly reflect business transactions, their associated events, and the processes that relate to them. They are arranged in an object-oriented hierarchy allowing attributes to be inherited, specialized, and reused. Event subscriptions are also part of this hierarchy.
For example, a Loan Business Object can act as a container for those data fields which are common to all loans, such as a Loan Identifier, Loan Amount, Loan Term, and Interest Rate. It would also contain objects for: integration with LOB applications and updates to the Credit System; customer details; loan lifecycle management options for origination, closing, servicing, etc.; relationship information such as agent or brokers involved; processes for loan approval, closing and exception handling; loan documentation such as credit reports; event definitions to trigger interactions and procedures; and rules related to procedures and credit scoring reports. The various types of loans and the different loan-related transactions are then developed as subsets of the Loan Business Object, inheriting its attributes and incorporating additional attributes to distinguish the type of loan, etc.

Business Objects are used to aggregate all relevant information pertaining to a specific type of business interaction. They can contain links to content such as electronic documents or scanned images stored in a FileNet repository or even a URL or UNC link to content stored outside the system. Cross-platform user authentication assures instant accessibility to all information, while retaining pre-existing security access controls.

Web Services can be used in a variety of ways within FileNet BPM. They can be used to invoke and publish processes, help define the structure of the Shared Data Space, and integrate with third party applications. A little more unusually, FileNet BPM will soon incorporate Web Service functionality into its BAM capabilities, invoking a Web Service to alert or invoke processes if a monitored Queue or SLA goes out of scope.

2.1 Platforms

The overall P8 platform is a J2EE environment that will run on SunOS, IBM AIX, HP UX, and Microsoft Windows 2000 Server (Server, Advanced Server) and Windows 2003 Server (Standard, Enterprise, Datacenter). Application/Web Servers supported are IBM WebSphere Application Server & Business Integration Server, BEA WebLogic Application Server, Jboss, and Tomcat. Databases are SQL Server and Oracle. If one does not want the J2EE environment, then the whole thing is accessible via Web Services (which is how they now support .NET). A full .NET API is due some time in the near future.

2.2 User Interface

All of the FileNet BPM functionality is 100 percent web-based; both the application components and API are accessible via a browser. All that is required to perform any function is a browser and the appropriate security credentials. Developer and Administrative clients generally connect directly into the Services Layer. FileNet has developed a set of Portlets (to the JSR 168 standard), delivering My Workplace, Public Queue, Browse, Author, Search, etc.

2.3 Scalability

Generally, FileNet BPM relies on the J2EE server to support scalability. An independent evaluation achieved 6.32 million transactions per hour on a scaled down 8-processor machine. The FileNet P8 Process Engine extensively leverages the capabilities of the underlying database environments (i.e., Oracle and SQL Server), such that each transaction is fully journaled by the database, with no information resident in memory. This robust architecture ensures that in the event of hardware or software failure, the current state of a transaction is known and is automatically completed or rolled back once the system is back online.

3 Processing Modeling

Processes are modeled as a series of steps (of various types) connected by transitions. Each step defines who will process the work, which attachments are required, the data required, what responses the participant can choose from, etc. Conditions attached to a transition define the logic of how work will
move from one step to the next. Work is routed through the system through individual and shared Queues or defined Workflow Groups (Roles).

Attached to each node of the process definition is a Step Processor application that provides the information and resources required by the user (instructions, attachments, field values, response options, and other resources needed to complete the work).

Out-of-the-box, the product comes with a number of Step types – General, System, Submap, and Component. The General Step sends work to a shared Queue, handled then by individual end-users or automated processes. At System Steps, the engine carries out one of its built-in system functions such as performing logic-control or setting time limits.

A Component Step represents a call to an external subsystem. Further custom step types can be developed and then added to the drawing palette. Further, a range of Web Service capabilities are delivered out-of-the-box (see Integration Section), in alignment with the WS-BPEL standard.

As far as the repository is concerned, process definitions are just another type of object and are arranged into a class hierarchy. This allows for common process attributes such as data fields, submaps, and milestones to be defined high up in the class hierarchy and inherited by those process definitions. This facilitates the development of consistent behavior across a group of related processes, expediting the overall development process.

Process models are further enhanced with Checkpoints and Milestones. Checkpoints provide the ability to roll-back an item of work, either partially or completely, if an error occurs. Milestones are linked to steps, both before and after execution, and can trigger events or messages. There are up to 99 levels of Milestones, which may be used to drive different levels of proactive notification to different roles in the business (or into customers and 3rd parties). This mechanism can be used to facilitate self-service applications.

3.1 Subprocesses

Apart from the class hierarchy, where different processes are specialized, depending on need, Submap Steps are embedded within a parent process definition. This allows the Submap to be called any number of times from within that process. Dynamic binding of subprocesses is possible via the Web Services interface. In such a situation, each process fragment is developed as a stand-alone entity and invoked either synchronously (triggered) or asynchronously (spawned). Moreover, process fragments developed in this way can be invoked by external applications.

3.2 Shared Data Space

FileNet BPM supports variables of virtually any type, including array variables (composite data types). Moreover, the associated content environment could also be thought of as a powerful extension to SDS.

3.3 Forms

FileNet Forms Manager is an XML-based eForms product that provides an intuitive design environment enabling general business users to create, deploy, and process eForms without extensive Web development or JavaScript experience. eForms are tightly integrated with the BPM platform supporting dynamic field validation and calculations.

The system can use virtually any other forms package that produces HTML, JSP, or ASP. FileNet Forms Manager integrates with an enterprise’s existing infrastructure to ensure that forms are widely accessible by supporting a variety of operating systems and browsers. It supports digital signatures and tracking for audit trails to meet regulatory compliance requirements.
3.4 Time

Process and Step Deadlines drive escalation to generate email notifications or automatically escalate the process via a configured escalation subprocess. Parameter driven deadlines, based on the process data, specify a time limit for the Step or Process instance completion. If a Reminder is set, the Tracker assigned for this process will receive a message prior to expiration. All time is rendered internally by the software as UTC (Universal Time Coordinated) and rendered to users in their local time zone, allowing processing to accommodate multiple time zones.

3.5 Process Optimization and Simulation

As part of Business Process Manager, FileNet delivers a fully integrated Discrete Event Simulation capability designed for end-user business analysts and managers. The process models used in the simulation are the same as those used by the Process Engine, and leverage existing process audit data to ensure process fidelity. (Most BPM Suites allow export of process data to external simulation capabilities, which then lead to the maintenance of two distinct models.) The Simulation Designer is used to define scenarios that use one or more process models created with Process Designer, including the specification of resources availability and costs. Simulation output data are displayed interactively within the tool to track desired Key Performance Indicators, and the data can be exported to the Process Analyzer for a more granular understanding of the simulation data.

4 Business Rules

FileNet BPM is able to address basic rules out-of-the-box through conditional statements. For more sophisticated rules and policy management, a separate rules engine, such as ILOG JRules, can be purchased. This engine enables process designers and business analysts to create and add business rules to processes. Business rules are associated with individual steps of a process in Process Designer, but are created in ILOG Jrules – a third party application purchased separately from Process Engine. Each step can have multiple rule sets that execute either before execution, on save, or after completion. The rules engine can: assign data to a field in the work item; send a work item to a submap; skip a step; or repeat a step.

Figure 2. The FileNet simulation environment is based on the core process models and leverage existing case data where relevant.
When the process definition is transferred to the Process Engine, the defined rule sets are transferred to the Rules Engine to create a Rule Set Skeleton, along with the data fields (system fields and user-defined fields) defined in the process. Business Analysts can then use the Rule Set Skeleton to define individual rules based on the available data fields.

![Figure 3. The Rules modeling environment](image)

### 5 Integration

The Integration Services functionality sits within the Services layer as shown in Figure 3. It handles all interactions with third party applications. Any third party or legacy application can be integrated as long as it exposes an API via a Java Class, JMS, Web Service, COM, .NET, or XML. Additionally, fixed adapters and connectors can also be used. Then, using the Component Step, developers can make these interfaces available as custom Steps on the modeling palette.

The FileNet BPM Suite provides support for Web Services on two levels – a Web Services API and Process Orchestration. The API exposes key functionality as Web Services, facilitating the development of custom applications that leverage the product’s Process and Content Management capabilities. Process Orchestration facilitates the interaction with other SOA components. It means that process definitions can both consume and be consumed as Web Services. This capability is provided by a collection of Web Services System Steps. Web Services are discovered from within the Process Designer by direct interrogation of UDDI (Universal Description, Discovery, and Integration) registries. As a result, the execution of specific process steps can be delegated to externally developed Web Services, regardless of development environment or platform.

It is worth noting that, if one did not want to use the J2EE environment for delivery, then the whole FileNet infrastructure is accessible via Web Services (which is how they now support .NET). A full .NET API is due some time in the near future.

Alongside these capabilities, FileNet also has a development framework. This is effectively a set of APIs and tools that sit on top of the core services layer.

### 6 Organizational Structure

FileNet BPM directly reuses the functionality of external Directory Servers. Options available include Active Directory, Sun-One, Novell, and, shortly, IBM Secureway. These systems are used for authentication as well as for deriving the organizational structure for Queues.
Queues typically reflect the structure of the organization (pulling that data from the Directory Server). The product also uses *Workflow Groups* that reflect the Roles of the business, or some other structure (such as matrix reporting) pertaining to each individual process definition. Workflow Groups can contain other groups, although there is no formal hierarchical structuring of them and they can even be modified while the process is *in flight*.

### 7 Process Adaptability

In the Business Logic layer, FileNet delivers two important capabilities out-of-the-box – the Case Toolkit and Collaboration Services. At the Presentation level, these are reflected in the Team Collaboration Manager and various solution templates that are either provided free or sold as add-ons to the main application. One of these is a sophisticated Case Handling template that allows multiple processes to be associated with a given piece of content. Moreover, suitably authorized users can decide which processes to associate with the case at runtime.

Team Collaboration Manager provides the contextual framework and a range of collaboration tools, including discussion forums, live meetings, and interactive polls, to enable group members to share information and participate in processes that facilitate group decision-making.

### 8 Process Lifecycle

Since the FileNet BPM Suite manages both content and process descriptions together, it becomes possible to build sophisticated applications that map the lifecycle of a content object type to the processes that are used to maintain it. Given that process models are regarded as content objects themselves, it is possible to construct applications that manage the business process lifecycle (N.B. FileNet has not delivered this sort of functionality out-of-the-box).

### 9 Monitoring, Measurement, and Management Information

![Figure 3. Example of a Process Analyzer Report](image)

Process Analyzer provides a variety of chart-based reports based on statistical information gathered from the Process Engine. Under the covers is an OLAP based repository that is used to store information about cases in the system. The Process Engine’s embedded logging subsystem ensures that all event logs are recorded in the same database transaction as the activity that they relate to.
Management information is typically displayed in a Business Management Console (BMC), which can leverage Microsoft Excel or other OLAP capable reporting tools such as Business Objects, Crystal Decisions, etc., as the reporting interface. More detailed analysis is available directly from within the BMC by clicking on the relevant report and drilling down to a more granular view of the data. Different groups of users are given different views of the same information within an OLAP cube.

Out-of-the-box FileNet provides OLAP cubes on Workload, Work In Progress, Queue Load, Cycle Time, and Productivity, allowing for the capture and representation of both real-time and historical information. These are further extended through user-defined fields, which are then presented as another dimension or measure on the cube.

10 Templates and Frameworks

FileNet provides a range of solution templates that accelerate application development. These are not shrink-wrapped business applications, but more process models and methodologies that provide a good start point for application development. This capability is offered with FileNet Business Process Application Development Framework (BP8) and a multitude of industry specific solutions offered by FileNet’s ValueNet Partner network. Examples include Case Management, Lending, Risk Management, Claims Management, and Compliance applications.

11 Vendor

FileNet Corporation is a publicly held company (NASDAQ FILE), employing approximately 1,800 workers worldwide. Headquartered in Costa Mesa, California, FileNet markets its products in more than 90 countries through its own global sales, professional services, and support organizations. It also has a well-established network of resellers, system integrators, and application developers. More than 4,000 organizations, including 81 of the Fortune 100, use FileNet technology to help manage their mission-critical content and processes. FileNet provides multilingual customer support worldwide on a 24/7 basis.

12 Cost

Pricing is based on a per server charge, combined with an additional cost for either concurrent or named users. Production capable, entry-level systems typically start at around $120,000, while the average sale is approximately $250,000. FileNet also has capacity planning tools designed to help customers determine the optimal solution that will scale to meet their needs.
Global 360 Enterprise BPM Suite

Version: 9.4

Global 360, Inc.
2911 Turtle Creek Blvd., Dallas, TX 75219
Tel: 214 445-4100    Fax: 214 219-0476
Web: www.global360.com    Email: information@global360.com

1 Product Overview

The Global 360 Enterprise BPM Suite is a comprehensive solution whose capabilities and features combine business process modeling, simulation and execution with automated monitoring and analysis, thus supporting the entire BPM lifecycle. Enterprise BPM Suite is designed to manage and optimize processes that span multiple applications, providing end-to-end process optimization across multiple “silos” of process automation.

G360 Enterprise BPM Suite supports process management for a variety of process types including both data and content driven processes. It is positioned to provide robust support for high volume, people intensive, and content intensive processes. Of particular note is G360 Enterprise BPM Suite’s business process analysis (BPA) module, which provides a process analysis data warehouse and multi-dimensional data analysis tools designed specifically for analyzing and reporting on process performance. Likewise, the Suite’s Process Simulator component supports both design-time and run-time business process simulation and optimization.

Finally, G360 Enterprise BPM Suite’s rich functionality is made readily accessible via a Performance Management Center dashboard that allows users to define metrics and key performance indicators (KPIs) to monitor processes in real time and to set alerts so they are notified should process performance stray out of acceptable bounds or not meet a defined goal.

2 BPM Engine

Global 360 has a layered architecture that provides customers with the option of deploying the components of the BPM Suite in a modular fashion. For example, companies could utilize an existing content management solution in place of Global 360’s native capabilities. Additionally, the Optimization layer can also be deployed stand-alone or extended across multiple process and transaction engines to provide end-to-end process visibility.

Server Environment

Figure 1 provides an overview of the Global 360 BPM Suite architecture. The Global 360 BPM Suite is comprised of key service layers that can be deployed independently or in conjunction with each other.

The Process Execution Services layer is the heart of the suite, managing both straight through and long running business processes, as well as the human interaction with the process and system/service integration.

Content Management Services manages the storage, retrieval and manipulation of content associated with the business process. Key capabilities of this service include document capture, versioning, archival and search.

The Optimization Services layer provides simulation, analytics and KPI/performance management, enabling both design-time and runtime business process optimization. The Optimization Services layer
is capable of optimizing processes that span multiple process execution systems, including BPM systems other than Global 360, thus providing an overall view of process performance. The Optimization Services layer is also available on a stand-alone basis (i.e., separate offering) as the Business Optimization Server (BOS) product.

**Client Elements**

Global 360 BPM Suite supports a variety of client interfaces including Microsoft Office, SharePoint and native web applications. In addition, the Suite provides a rapid application building environment which analysts can use to assemble rich process applications with zero coding. Forms-based interaction support is provided via integration with Microsoft InfoPath.

**Web Services**

The Global 360 BPM Suite has a rich SOA infrastructure, enabling both Web Services consumption and provisioning. Web Services integration can be modeled and tested as a process activity with zero coding. Processes can be enabled as Web Services and are published to either an external or a built-in services repository. Services orchestration is enabled through a combination of these capabilities.
2.1 Platforms

The Global 360 BPM Suite is based on the Microsoft .NET platform and requires deployment on Windows servers. A relational database is also required, such as Microsoft SQL Server or Oracle. In addition, the Business Process Analysis (BPA) module requires the use of SQL Server’s Analysis Services. The runtime services of the Global 360 BPM Suite are based on the Microsoft .NET platform. From an end-user application perspective, applications can be deployed using a variety of application server platforms, including J2EE, JSP, ASP, ASP.NET and others. Additionally, leveraging the SOA based platform API infrastructure, BPM Suite supports interaction and integration with virtually any service enabled platform, ranging from Java to Legacy to Microsoft.

2.2 User Interface

A variety of end-user interfaces are supported natively within the product, including Microsoft InfoPath, SharePoint, Office, custom applications (both thick and thin client) and applications built using Global 360’s Application Designer. Application Designer allows a business analyst to rapidly assemble end-user applications using over 20 pre-built web application components provided by Global 360. Partners and customers can also extend this library to support other advanced customizations.
2.3 Scalability

Horizontal and vertical scalability are inherent to the architecture of the Global 360 BPM Suite. Both the Process Execution and Content Management Services employ an agent-based model that can leverage the processing power of any number of CPUs on a physical machine. Additionally, horizontal scalability is supported through clustering and failover technologies such as Microsoft Clustering Services. The Business Optimization Services layer is a fully managed .NET application that leverages the inherent capabilities of the application server for both horizontal and vertical scalability.

3 Processing Modeling

Global 360 features an integrated, multi-tiered modeling environment that allows the business and process analyst to focus on the actual business process, while enabling systems analysts to develop the supporting implementation based on the business process. Additionally, web based renditions of the business process are available for business process owners to make adaptations to changing business conditions. These adaptations include changes to KPI goals, decision-making and work routing rules and other parameters. This architecture enables rapid change and adaptation without compromising core system and process integrity. The process model and associated rules are stored in a common managed repository, obviating the need for model synchronization as changes are made.

Process modeling and definition is facilitated with the Process Modeler. There are two editions of this tool:

*Designer Edition with Simulation*

This is the Global 360 tool for drawing high-level business process models based on the standard Business Process Management Notation (BPMN). Designed for the business analyst, the Process Modeler provides a simple means of communicating process information to other business users, process implementers, customers, and suppliers.

The integrated Process Simulator is designed by business processing experts and uniquely created for business process simulation. Multiple scenarios can be simulated and results can be analyzed in an online process statistics view panel and optionally published to CSV, XML and HTML files. This robust forecasting tool is used for exploring “what-if” business scenarios. For example, a business may want to determine the effect that a region outage due to a weather situation will have on their ability to meet their service-level agreements. The simulated scenario data can be seamlessly sent to the Global 360 Analysis Engine for reporting and analysis.

*Builder Edition*

This version features an intuitive graphical modeling interface that allows business analysts and business process owners to easily define business processes by dragging and dropping worksteps into a process map. No programming is necessary. In addition to defining business processes, it is possible to configure rules governing how those processes will execute, specify resources to perform steps within the process, and indicate business goals for which the process must optimize.

3.1 Subprocesses

Process sub-setting is fully supported in the Global 360 modeling environment. Sub processes, or process segments are stored and managed independently, enabling reuse across multiple process projects. Additionally, processes may have any number of “entry points” which further enables the process segments to be reused on a stand alone basis (i.e. Accounts Payable), or as a component of a larger business process (i.e. Order to Cash).
3.2 Shared Data Space

Global 360 has a robust infrastructure for managing business objects such as images, documents and other data associated with the business process. The Content Management Services layer enables the storage of this information to be spread across multiple redundant physical storage devices and supports a wide variety of media types including traditional magnetic disk / SAN storage, optical storage and specialized devices such as EMC Centera.

3.3 Forms

The BPM Suite includes several options for deploying end-user forms. The native Application Designer facility in BPM Suite allows analysts to lay out both data and document-driven forms. Look ups and validation modules can also be easily plugged into the extensible framework. Additionally, customers may leverage out-of-the-box integration with Microsoft InfoPath or integrate with other packages such as Adobe Forms.

3.4 Time

The BPM Suite features full support for business calendaring and international time zones allowing working days, hours, shifts and time zones to be factored into various process calculations, measurements, deadlines, etc. This capability is important, because the majority of Global 360’s customers are large, multi-national corporations whose processes span multiple time zones, geographies, and nationalities.

3.5 Process Optimization and Simulation

Global 360 offers optimization both natively in the BPM Suite as well as in the form of an independent product (Business Optimization Server), enabling optimization for business processes that span multiple silos of process automation. The Optimization Services layer has three key capabilities that enable both...
design-time and runtime optimization. Design time simulation is supported to perform “what if” analysis for a variety of process problems ranging from ROI analysis to disaster recovery planning. The second component is a core analytics repository that allows actual process results to be stored alongside simulated changes enabling true “as is” and “to be” comparisons (process analytic capabilities are discussed further in section 9). Actual workloads and resource availability may be used as inputs to the simulation, enabling “real world” comparisons. Lastly the performance management service enables automated, real-time adjustments to resource assignments, priorities and other processing variables. This is driven based on business goals, which may govern the process behavior. Process status is available in a real-time dashboard environment know as the Performance Management Center.

The Performance Management Center consists of a set of browser-based configurable dashboards that function as a management tool to provide visibility into various aspects of the business process. As illustrated in Figure 5, the Performance Management Center can display real-time statistics pertaining to workloads, productivity, goal attainment, and KPIs, thus providing in-depth visibility and operational control.

![Performance Management Center dashboard.](image)

**Figure 5. Performance Management Center dashboard.**

### 4 Business Rules

Global 360’s BPM Suite features a native business rules capability that supports sophisticated features such as factoring in both current and projected KPI attainment into the decision-making process. In addition, integration with Corticon Technologies’ business rules engine is also available as an option to BPM Suite customers.

### 5 Integration and Integration Engines

Integration of the Global 360 BPM Suite with third-party systems is accomplished through SOA / web services, or through legacy-oriented connectors to systems such as Microsoft and IBM MQ Series. An integration framework, engine and accompanying drag-and-drop/configuration toolset (Process Modeler) supports process-based integration to back-office ERP systems and other data sources, as shown in Figure 6.
The integration framework provides a set of pre-built, configurable connectivity worksteps specific to application integration that are designed to enable process designers to easily integrate applications into automated business processes. Worksteps enable connectivity at the data, service, and application levels:

1. **Data level**—worksteps that “talk” directly to data sources, such as SQL databases. Features a wizard-based tool that enables the Process Modeler to inspect a database and then construct a query or insert based on defined tables and fields.

2. **Service level**—worksteps utilizing higher-level connectivity infrastructure loosely coupled with the target application. They include Web services and messaging such as JMS, IBM MQ and MS MQ, IMAP/SMTP, etc.

3. **Application level**—worksteps that interact directly with target applications such as SAP, PeopleSoft, and Oracle.

In addition, Global 360 BPM Suite’s integration framework allows corporate developers and business partners to extend available worksteps to create application, technology and vendor-specific integration worksteps.

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6 **Organizational Structure**

Global 360’s BPM Suite provides a number of options for routing based on organizational role and responsibility. Roles and responsibilities can be imported/synchronized from ERP and HR systems such as SAP, or dynamically retrieved from directory services such as LDAP. The platform’s flexible architecture allows for sophisticated routing and assignment scenarios that enable work to be routed to the right person at the right time.

7 **Process Adaptability**

The Performance Management Center (PMC) component of the Optimization Services layer of the BPM Suite allows users to define business goals or KPIs that effectively govern process behavior based on desired business outcomes (Figure 7). Typical process adaptations take the form of work reprioritization or re-routing and resource reassignments, however, more sophisticated adaptations can be modeled directly within the process with virtually limitless possibility. Additionally, customers may manually tune these same sets of parameters as well as adjust the KPIs based on changing business conditions. All this can be achieved without traditional change management cycles.

8 **Process Lifecycle**

Global 360’s BPM Suite provides an integrated environment that supports the entire BPM life cycle. This includes modeling, simulation, execution, analytics, improvement (run time adaptation) and ultimately, optimization. One of the key components that enables this integrated set of capabilities is
the Global 360 process repository, a feature of the Content Management Services. By utilizing a common repository, Global 360 obviates the need for synchronization and enables subprocess reuse. This infrastructure is also key from a change management perspective as to when new process versions are promoted; customers may opt to either change all running processes to the new model, or alternatively implement a co-existence strategy with new processes on the new model and existing processes on the old model.

![Figure 7. Defining business goals, KPIs and alerts in Performance Management Center.](image)

9 Monitoring, Measurement, and Management Information

The Performance Management Center is a key component of Global 360’s business activity monitoring (BAM) and Optimization infrastructure and is described in previous sections. Additionally, an online analytical processing-based (OLAP-based) Business Process Analytics (BPA) Engine is also included as part of the Optimization Services. Essentially a packaged process data warehouse, the Analytics module organizes both historic and real-time process data in the form of an OLAP cube designed to support multi-dimensional analysis and reporting of process information. (Process event and contextual data are provided to the Analytics Engine via open interfaces, allowing third-party product processes and system events to be included in the process data warehouse.) Examples of supported dimensions include the length of time required to complete a process, the most productive departments, and the cost of performing a task, etc. These capabilities help managers and analysts understand where process opportunities exist by identifying process bottlenecks, underutilized resources, and end-to-end as well as sub-process processing times, etc. (Figure 8). Global 360’s open interface also allows customers to use familiar office productivity tools such as Microsoft Excel for data analysis, or leading business intelligence (BI) tools such as Tableau, Cognos, and Business Objects with the Analytics module.

G360’s BPM Suite provides an inter-enterprise class platform for deploying business process solutions. In this environment, processes tend to be highly distributed, linking people, content, and systems from any location. These types of solutions can be a challenge to administer, as most resources are not centrally located and are remote to the system administrators. To address the issue, G360 Enterprise provides an Administration application that includes all the tools necessary to configure and deploy BPM solutions. The Administration application is browser-based and can be run from wherever a system administrator has secure access to the system.

The Administration application is capable of configuring the following elements of a G360 Enterprise solution:

- Managing user logins with groups and profiles
- Configuring sites, databases, and directories
• Defining the process data model
• Defining and monitoring process execution tasks and schedules
• Creating process components such as capture parameters, barcodes settings, and worklists
• Defining and managing the content repository
• Configuring storage devices

10 Templates and Frameworks

Global 360 offers several pre-packaged templates for horizontal applications such as Accounts Payable, Compliance and Customer Correspondence Management. In addition, Global 360 has deployed literally hundreds of applications in key financial services and insurance areas such as underwriting, loan origination, customer enrollment and others. Packaged services “quick starts” are available for these processes as a component of a broader customer solution.

Figure 8. Monitoring/analyzing processes with Optimization Services’ Analytics module.

11 Vendor

Global 360 is a privately held company focused on Business Process Management. As a vendor of BPM software, Global 360 was founded in 2004 (and was previously known as eiStream, Inc.).

Today, Global 360 has over 400 employees and offers a comprehensive and advanced line of business process management offerings (its Enterprise BPM Suite is currently in version 9.4, and it markets other BPM products, including BOS, G360 Case Management and G360 Work Management, among others).
Global 360 can also point to a large base of approximately 2,000 customers, which include 7 of the top 10 insurance companies and 16 of the top 20 financial institutions worldwide. In addition, it has more than 100 partners and resellers. All of these are testament to Global 360’s well-defined strategy and strong product focus, which centers on offering a solution that supports the entire BPM lifecycle—from business process modeling, simulation, and execution to automated monitoring, analysis and optimization.

Because Global 360 is privately held, it does not release detailed financials; however, representatives indicate that the company is profitable with annual revenues in the neighborhood of US $80 million. Majority financial sponsorship is provided by TA Associates, a leading technology buy out firm headquartered in Boston, Massachusetts. Global 360 invests upwards of 20% of revenues in R&D on an annualized basis.

Global 360 is headquartered in Dallas, Texas with over 15 offices worldwide in the United States, Europe and the Asia / Pacific region. US offices are located in: Alameda, California; Nashua, New Hampshire; Bethesda, Maryland; Rochester, New York; New York, New York; Melbourne, Florida; San Antonio, Texas. International offices are in: London, Paris, Madrid, Stockholm, Brussels, Amsterdam, Milan, Rome, Hong Kong, Quebec, Shanghai, Sydney, and Melbourne, Australia.

12 Cost

The Global 360 BPM Suite is priced based on a combination of server and user licensing. Definitive pricing was not provided.
1 Product Overview

The GT Product Suite (GT-X) is a BPM platform that is born from a long heritage of contact center development and is rich with connectors from that domain. The product readily supports high volume, high volatility business processes and is typically deployed to enable cross-channel customer-interaction processes. Of course, it is not restricted to that environment—it is just that the product is tuned to easily support the development and running of these complex process scenarios.

Underpinning GT-X is a flexible, multi-channel development framework for creating and deploying complex business processes. At its core, GT-X is a BPM development environment based on an object-oriented paradigm. It enables the rapid development of business process applications that can deploy across several different user interface clients. The GT-X product suite consists of the GT-X BPM Platform, the GT Process Portal, and a number of GT Operational Modules:

- The GT-X Business Process Management platform supports the collaborative definition and subsequent direct execution of complete application models, including high-level graphical descriptions of the process, user interface, and integration layers. The platform supports the full process improvement lifecycle, from requirements capture through design, monitoring, measurement, analysis, optimization, and deployment; appropriate definition and management tools are provided for both business and technical users.

- The GT Process Portal is a process management, reporting, delivery, monitoring, and auditing environment that forms the basis for delivery and improvement of enterprise-wide business processes. It is itself a GT-X–modeled application and is supplied in source model form. Work blending allows users to be allocated work from a variety of sources in a way that is transparent to them. Sources include inbound telephone (CTI), outbound telephone (via CTI or Dialer), and/or GT Workflow. The workload is prioritized by the system and can be configured to enforce SLAs or any priority mechanism of choice. Administrative users have the ability to override this by allocating users to specific channels in real time.

- Operational modules are fully functional and extendable applications that sit on top of the GT-X BPM Platform and are designed to run within the GT Process Portal. Applications include Case Handling, Contact Management, Correspondence Management, Marketing Campaign Management, and Product Catalogue. Each is a combination of GT-X process templates, developed screens, data entities, and objects.

The underlying object-oriented environment is extremely flexible and can represent virtually any business requirement. Third party applications are integrated directly at the object level (effectively wrapping functionality and data types) and are then accessible in the modeling environments.

A unique capability delivered by the product (in the BPM world at least) is the ability to support “Natural Human Interaction”. This feature is primarily used to deliver self-service customer interaction over natural language channels, such as IM text-chat or voice. Effectively, the system uses the process model (the action fulfillment part of the system) to generate a human “conversational” dialogue. The
process provides the context for action. The product supports the development of the underlying grammar related to the process, such that the system can handle human interaction responses appropriately. It looks ahead at the process model and builds a richer grammar around the goal of that process rather than just a step.

The resulting natural language dialogue that a specific user has with the system (may be a customer, employee, or partner) is always specific to that interaction. The system not only understands natural language; it goes beyond understanding the actual words, to understanding the underlying meaning of the combination of those words. The system-generated outgoing prompts are based on the dialogue context, which is driven by the user. User input is parsed to identify and satisfy goals with respect to the underlying processes (it will attempt to identify the most appropriate processes from the initial context). For example, if a customer says “I have lost my wallet.” The context may trigger the “Lost or stolen credit card process,” or “Replace travelers’ checks”, or it could trigger “buy a new wallet and send it through the post”. The system then generates prompts to assist progress through the selected process toward its overall goal. By default, the initiative lies with the user. They can specify goals, information, and requests, which are used or stored until such time as they are useful (the user should never have to specify the same piece of information twice). Occasionally, in order to progress a process towards a goal, the system will take the initiative and prompt the user for remaining pieces of information. The predictive engine can manage multiple concurrent logical threads in a dialogue and allows a user to freely switch between them.

2 BPM Engine

The heart of the GT-X architecture is a process modeling and direct execution approach. The business process platform directly executes the process model, with no interim code generation or break in the flow from expression of business process requirements through to their exact execution.

![Figure 1 – A logical view of the GT-X Architecture](image)

The architecture is optimized for the customer-centric processes. The GT-X framework consists of the following logical functionality groupings:

- **Toolbox**—consists of a range of development tools used to define processes. Toolbox is highly customizable, allowing customers to load appropriate tools for different classes of user.

- **Repository**—stores processes and the software components that comprise them. The Repository can also utilize a version control system for multiple developers working in the same environment. Processes are developed and stored in the repository in XML.
Process Kernel—consists of two distinct Process Engines that work in harmony to deliver the BPM platform. One handles synchronous interaction processes (with users and customers), while the other supports the longer running business processes involving multiple roles.

Clients—provides the user interface to the application. The use of different types of client provides the multi-channel functionality.

The Process Kernel is event-state based, with the core of the system residing inside the J2EE container of a modern application server. At the lowest level, functionality is split to enable in-memory execution for short running processes (typically user interface interactions) and, at the same time, the long-running business process is “dehydrated” to persist overall process state in the data store (typically an RDBMS). Full two-phase commit support ensures that transactions remain consistent across a number of applications.

The fundamental item types in the GT-X Repository are Processes, Packages, and Objects:

- Processes—represent real-life business processes, and control task flow and navigation. There is no differentiation between levels in GT-X; a process can represent an entire business process, a step, or an activity within that process, or even the navigation through a pane in the forms environment.

- Objects—are the things upon which an application works. For example, Objects can represent customers, resources, products, or just about anything of interest. Objects have “Procedures” associated with them to manipulate their data. For example, an Account Object may have the Procedures getBalance and addTransaction. Procedures are the “Methods” of the Object.

- Packages—are similar to directories on a file system. They contain other items. Typically, Packages are used to group related things together (for example, the coded Processes that make up an application). Packages also control Object scope.

There are various other types of items in the GT-X Repository that support application development:

- Forms—create the user interface for the application.

- Events—are used to synchronize aspects of the application, such as merging threads of a Process or ensuring Forms work effectively together.

- Records—are simple data structures used to store information for the application. For example, a name and address might be stored in a Record. Records might be thought of as the “variables” of the process, but do not have Procedures associated with them (as do Objects.)

- Database Objects—represent Records from a database table. For example, an Orders table would be represented by an Orders Database Object.

In addition, there are a number of specialized types that support the way items are presented (Lists, Fetches, Views, and Representations).

GT-X is capable of making extensive use of Web Services. It can both consume and expose processes as Web Services. Additionally, it can expose the Worklist and Administration functions as Web Services. It is also possible to monitor external applications via Web Services, with the data incorporated into the GT-X process-monitoring dashboard (creating more of a BAM style application.)

2.1 Platforms

GT-X currently runs on Sun Solaris, IBM-AIX, Microsoft Windows 2000, XP & 2003, Linux (for Intel), and HP-UX. A J2EE-compliant Application Server is required, with verified support for Sun JES Application Server, IBM WebSphere, BEA WebLogic, and JBoss. The GT Process Browser, which is an
optional application for use within high-volume call centers, requires Microsoft Windows 98, NT, or later. From a database point of view, GT-X supports most modern RDBMS platforms, including Oracle, DB2, SQL-Server, and MySQL.

2.2 User Interface

In GT-X, the entire user interface is driven by process models, which interact, as needed, with longer-running processes. The synchronous interactive process engine could be thought of as a Screen Handler and runs in memory for optimization purposes. The idea is to build a set of processes that deliver the desired functionality for the application, rather than having a distinct client.

A complex application is normally composed of several different process interfaces that are managed and maintained individually. As they are separate process components, changes to one need not affect the others. This allows developers to insulate parts of applications from each other, allowing those parts to evolve independently, as required by the business. Individual Forms and the Processes that support them are stored as part of a Package and deployed together.

By storing, managing, and executing the user interface definitions centrally, GT-X allows maximum reuse across all access channels and easy delivery of processes to different channels. Moreover, each Form is rendered dynamically at run time. The product recognizes the browser signature (of the client device) and adjusts the behavior and appearance of the Form accordingly. In this way, multi-channel functionality is delivered. The overall net effect is a lower cost of ownership.

From the user’s perspective, the GT Process Portal is a task-driven environment tailored to individual needs. It acts as a gateway to all process-related work. User access is possible via an Internet Browser, through the GT Process Browser (a thin-client application designed for high performance), or via third-party Portals environments (GT Process Portal supports the WSRP and JSR 168 standards).

A taskbar provides access to all the processes which the user is entitled to invoke (based on role). A sorted work list view is also provided, allowing users to select the item of work of greatest importance. This list is configurable to present sorted work based on SLA expiry or type, and is fully customizable by individual users. Supervisors can view work lists for individuals that they manage and get an overall team view of the workload.

2.3 Scalability

GT-X conforms to the formal restrictions of the J2EE Application Server environment to ensure that it delivers scalability, fail-over reliability and security. As mentioned earlier, GT-X delivers a unified BPM platform that supports both synchronous user interaction dialogues and multi-user, long running
business processes. The two process engines that deliver this functionality are distinct components within the J2EE infrastructure, each tuned to support better performance. For example, the engine that handles synchronous processes runs in memory to ensure rapid screen refresh rates.

The GT Product Suite provides additional technology for scaling to very high interaction counts, such as those reached within a high-volume contact center. Despite the obvious advantages of a thin-client approach for enterprise applications—especially a process-oriented solution subject to continuous improvement—the use of a generic HTML browser can cause certain performance concerns. The need to continually build and communicate complex forms to a logic-free browser on a user’s desktop can result in poor screen refresh rates, can stress intranet bandwidth and can eat into server processor cycles. In the absence of a current standard solution to these performance concerns, the GT Product Suite provides the GT Process Browser running on the Microsoft Windows platform. This uses binary protocols and intelligent caching for Form definitions to eliminate the overheads normally expected of a thin-client solution. On the other hand, it is essentially a thin-client application requiring no reconfiguration following initial installation.

3 Processing Modeling

In GT-X, the “semantics” of process modeling are relatively rich, enabling the Process Kernel to drive a contact center screen as a process (rather than as an application). The overarching business process invokes other Processes and Objects at steps in the process, including detailed screen mapping, calling Web Services, executing rules, etc. All of these are specialized types of processes. All of these modeled processes are stored within the Repository in an XML form.

Figure 3 – Both BPMN and UML process modeling methods are supported

For example, in a customer contact center, the developed application is in a state of waiting for a call. An event happens (the call), triggering the call-handling process, which immediately tries to work out who is calling (based on caller-id). It might then try to figure out why they are calling and subsequently, based on the goals of the identified process, the system will use its predictive capabilities to determine
how completion is reached, and trigger other things that the organization may want to do during that call.

When a process executes, it continues down all available transitions until it detects that an “Event” is required. It will then pause until that event happens (say a user selects the Yes or No option), or a business rule executes somewhere else in the process and fires the event programmatically.

The GT-X Toolbox is a customizable collection of development tools that support the creation of BPM-enabled business applications. Each tool is optimized to provide functionality for different types of users. Each can be further developed and released independently:

- Analysis and Design Tool—provides a high-level, BPMN-style tool for process modeling. It features swimlanes for role assignment and process prototyping, as well as a process hierarchy and dataflow capabilities. This tool also provides simulation and form prototyping capabilities.

- Interaction Dialogue Tool—provides a richer set of process semantics to support synchronous execution models necessary for real-time call-center screen interactions and lower-level integration. The underlying event-state model of the modeling environment is richer, as are the data transformation capabilities and integration mechanisms.

- Form Tool—is used to build the graphic canvases (See the Forms section.).

- Rules Tool—provides a business user with the ability to model and control business rules used within the application.

### 3.1 Subprocesses

In GT-X, processes invoke other processes. Interactive processes act like a subprocess of a longer-running business process. Each invoked user interaction is a separate process instance, handled by the synchronous process engine (but linked to the parent business process). Of course, the product also supports asynchronous process invocation, effectively spawning a separate process instance. In a sense, the spawned process stands alone, but can be resynchronized with the calling process using the event functionality. Asynchronous behavior is event-based, whereas synchronous behavior is flow-based.

### 3.2 Shared Data Space

In GT-X, developers define Objects, including the data an Object holds and the methods the Object uses to act on that data. A Process is a first class Object within the GT-X model, in that it can have attributes of any type. This includes all of the data structures that one would expect to find in a mature object-oriented system, including lists, arrays, etc. GT-X also supports three subtypes: range, enumeration, and pattern.

The rich internal object model within GT-X means that the product can internally represent just about any document. This means that the process engineer has the choice to leave data in third party systems and reference them there. Alternatively, GT-X itself can own the data. In any case, GT-X has full power to receive these data items, manipulate them, present them to the user, store them as part of the process data, and pass them as parameters/messages to third party systems.

Usually, a developer will create a compound or logical Object and map it back to several external applications. For example, a Customer Object may be composed of an address match from one system; a part of a billing record from another; and the customer account status and YTD sales from a third system. Once created, the process modeler (or end-user) will interact only with the logical Customer Object. At execution time, GT-X retrieves all of the related information seamlessly.
3.3 Forms

GT-X is extremely flexible when it comes to designing and rendering a graphical user interface. It can produce complex Form layouts and has been used to produce a large number of ergonomic call center agent screens. GT-X Forms can be served to a wide variety of thin clients, including the GT Process Browser, HTML browsers, WAP clients, Java clients, and dialogue-enabled clients.

The GT-X model of user interfaces is based on a Form and component model, where each Form has a set of defined components (for example, data entry fields, lists, etc.), and each component has a set of properties. Any Form can include other Forms as components, allowing a hierarchical structure of Form components. Each Form would normally represent the interface for one sub-process.

The idea is to model the user interface in abstract terms, and then have thin clients deliver the abstract definition to their own client environments. The GT-X framework uses “Platforms” and “Representations” for clients using markup languages (notably HTML, WML, XML, and VXML). Platforms are arranged into a hierarchical family, to allow more detailed handling. Representations are effectively server-side JavaScripts that execute to return the appropriate markup for the component (each supported device has its own set of Representations). In other words, a button uses the underlying details of a label, font, and action to prepare an appropriate markup string. A rich Representation library for common platforms comes as standard with GT-X and provides multiple examples for components (for example, several ways of representing a list on an HTML page). This library is customizable and extensible by customers and partners to support individual projects if needed.

Figure 4. Rich user interfaces are driven by interactive processes through the GT-X Process Portal

The GT-X model allows the definition of different Representations for each platform at the component and Form levels of the user interface. Different Forms can be selected for the same interactive process, allowing significantly different UI presentation for the same underlying interactive process behavior. Furthermore, the interactive processes themselves can be parameterized by channel and platform, yet still reusing all non-graphical business process elements including integration services, entity models, and services (for example, how to create a new customer), and business rules. Cascading styles enable a uniform look and feel throughout an application.

In development, default Forms are auto-generated to display the input and outputs of processes, thus enabling rapid prototyping. Users then refine these Forms using a WYSIWYG GUI builder (the Form
Tool. The Form Tool provides a drag and drop environment that supports nested Forms, ActiveX controls, customizable dashboard widgets, the definition of client-side validation and rules, and the reuse of components. Components can be bound to the process variables to display data at runtime. Developers can also customize the available components and then apply them across multiple Forms.

In addition to dragging and dropping components, GT-X Object Views enable rapid Form development by auto-generating components based on the associated Objects. As a result, developers simply select those that they wish to view on the Form. Using nested Forms enables the developer to more easily build user interfaces that rely on different collaborating processes. For example, in a call center, the inbound call might execute a caller-id process to attempt to retrieve the likely user and their name (taking perhaps less than half a second). Meanwhile, another part of the screen is retrieving a more comprehensive picture of that customer’s current status, contact history, outstanding work items, and such (like working with a different set of processes that might take 4 or 5 seconds).

Alongside the Form Tool is a Script Text tool to prompt call-center users to say the right things when using the system and talking to external customers or suppliers.

3.4 Time

Time-based events can be related to specific activity nodes, as well as entire user sessions. “Timeouts” are defined as either duration (from a fixed point) or an absolute time, based on literal or variable values. They can be relative to any stage of the process or activity or, indeed, outside the session itself. This gives the flexibility to create a range of different patterns for time-based activities. When Timeout durations expire, the engine fires a Timeout transition in the process (either an “Escalation” or an “Alert”). Escalation and alerts do not necessarily change the state of the process.

Design-time durations can be altered in real time; allowing time-based conditions such as Service Level Agreements (SLAs) to be shortened or extended (either programmatically or via user intervention). For example, this allows GT-X to send an alert to a manager one week before passing a deadline (to allow the manager to expedite the work, ensuring the item does not go past its SLA). Should the deadline change during the life of the case, the alert will adjust its behavior accordingly.

Processes can define customizable escalation paths providing the ability to escalate or notify in a process-specific way. For example, the process might initially send an alert via e-mail. As the deadline approaches, the process could send an SMS text to remind the supervisor, with the work item automatically moved to a different queue. The target of an escalation is associated dynamically, and can be based on organizational structure (e.g., notify manager) or other business rules.

GT-X time durations are based on Greenwich Mean Time (GMT) and, through localization, allow disparate users to view time durations in their local time zone and format.

3.5 Process Optimization and Simulation

Simulation in GT-X focuses on the longer-running business process and is aimed at business users rather than simulation experts. Simulation does not yet perform automatic optimization, but can be used to aid ongoing process improvement.

Scenarios are created against process models, with an ability to save multiple scenario objects for any given process model. The components of a scenario are node duration, branch probability, arrival rates, and work pool resources (worker numbers and costs per hour). Arrival rates can be expressed as fixed or variable, via a small range of probability distribution.

Significantly, simulation may be driven by real data, as well as the designers’ educated estimates. Real data can automatically be collected (metrics) and readily imported into the scenario to aid process refinement.
As the simulation executes, the queuing levels present at each node on the process graph and the number of resources currently engaged in each activity are super-imposed on the process. This can show workers congregating around the same activity, while the queues on the other nodes in their swimlane overflow. In such a situation, the solution may be to split the workgroup's responsibilities, creating a dedicated work pool for the troublesome activity. Output focuses mainly on utilization of resources, but also covers timings for each path through the graph. All of the results are exportable, allowing them to be loaded by mainstream analysis tools.

### 4 Business Rules

GT-X provides an integrated business rules environment to support the automation of business decisions and control business events. GT-X business rules are inference-based, and the GT-X rules engine is forward-chaining. It adheres to JSR-94 standard, which means that it can readily plug-in a third-party rules engine.

The Rulebook Tool is a purpose-built, graphical rule editor designed for the business user. Rules are developed in pseudo-English, based around the variables associated with the process. The Rulebook Tool is one of the tools provided in the Toolbox development environment. The business user would normally only have access to the rules under his or her control—i.e., other, more technically oriented tools would not be available to them.

Boolean conditions, events, exceptions and variables describe individual rules. Rulebook Processes are integrated with the process graph, meaning that they can be dragged and dropped as any other object. Rulebooks can also be attached to a process.

By default, the rules operate on the same data space as the process models. It is also possible to store and retrieve them from a database, if necessary.

![Rulebook Tool](image)

**Figure 5 – Business users control the rules associated with their role**

### 5 Integration

Developers can introspect virtually any application at the API level (or via a Web Service), capturing its internal structure and importing it into an internal Object that maps to the external entity. As discussed earlier, GT-X supports Logical Objects that help insulate processes and data from needing to know anything about the underlying implementation. As a result, the Logical Object (Customer) can stay the
same, but the underlying implementation can change without affecting any of the higher-level usage (and vice versa). A visual mapping tool (in Figure 6) is provided as part of Toolbox to help create that logical object and support the various data-level transformations that may be required.

Figure 6 – A graphical data modeling tool is provided for compound object types and to support any data transformation that may be required.

GT-X also provides a set of introspection and import tools, one for each particular integration technology. So, for example, the Web Service tool ‘imports’ Web Services from a UDDI registry. It does this by reading the necessary WSDL descriptions and creating the appropriate Web Service types within the GT-X Repository. Currently, there are similar tools for Enterprise Java Beans, Java Beans, Active X Controls, RDBMS schemas (via JDBC connections), XML Schemas, and Cobol Copybooks.

GT-X provides comprehensive JMS integration, supporting interaction with industry standard messaging systems, such as IBM's MQ Messaging, TIBCO JMS, and BEA's Tuxedo. The product also provides BizTalk support via the JCA protocol, designed specifically to support integration with SAP. GT-X is SAP CA-XML certified and can integrate with SAP R/3 via open and non-proprietary standards.

GT-X also supports a proprietary “Service Object” integration type for real-time, event-driven interfaces (for example, telephony devices). These Services may be invoked in a synchronous or asynchronous manner, allowing for multiple services to be initiated in parallel for optimized performance. Service Objects can also raise unsolicited events to the business process, such as a telephony adapter indicating a call being dropped. Service Objects connected through a grouping of brokers that allows loose coupling of services and facilitates scalability of the whole system. Off-the-shelf Service Objects are available to integrate with virtually any third-party C/C++ system.

The product can make extensive use of Web Services. It can present and consume processes as services, as well as exposing the Worklist and much of its administrative functionality as Web Services. JMS messaging, EJB, CORBA, and COM+ interfaces can also be used to invoke processes.

6 Organizational Structure

GT-X includes an administrative tool (in Toolbox) for administering users and roles, and setting up security. Users are assigned to one or more roles. GT-X implements runtime identification and authorization via a pluggable interface (Security Provider) that is compatible with the Java JAAS specification. GT-X provides out-of-the-box support for its own implementation of a Security Provider, as well as direct support for LDAP. Security Provider allows abstraction above LDAP and AD, re-using their existing capabilities, rather than importing. When a session connects, it talks to the Security Provider that verifies that the user is valid and has access rights to the various objects. More specifically, user access to elements of functionality in the GT Process Portal is controlled via the role-based security mechanism. This approach is a step further than the normal work-assignment-by-role approach to security that other BPM engines provide.

User or role identifiers are used in two ways within the GT-X Process Model. First, they can be used as security markers on processes. Any user that attempts to run an interactive process (or instantiate a business process) with an assigned security marker must be listed as an authorized user, either by user
identifier, or by role. Unauthorized attempts to execute processes—at any process depth—will result in a security exception. The process model may define how to handle security exceptions; unhandled security exceptions result in the termination of a client session. At design time, activities within a distributed process are marked with participant includes and excludes list. The includes list is a list of all users or roles that are eligible to perform the activity; the excludes list is a list of those users or roles that are ineligible to perform the activity.

7 Process Adaptability

For audit reasons, no attempt is made to allow existing process instances a move to a newer version. However, process designers may mix and match design-time process execution choices with choices made by knowledge workers at runtime, allowing for a certain degree of free choice within a more rigorously defined framework.

Particularly relevant to customer-centric processes, is a comprehensive Case Handling capability. The developer designs a parent Case Object and then provides the ability to attach loosely coupled processes to it at runtime. The Case would also likely have a wide variety of other Objects associated with it, in much the same way that a manila folder can contain many documents. Depending on the business scenario, the Case could have documents, customers, resources, assets, or just about anything else in the instantiated object model.

Subtly different, the predictive engine within the GT-X platform offers a certain degree of freedom within a pre-defined process structure. This is primarily used to deliver self-service process interactions over natural language channels, such as IM text chat or voice.

8 Process Lifecycle

A typical project will have various runtime environments covering development, test, and production. Each can either run against a single repository instance serving across all the environments, or can have its own repository instance. In a multiple repository configuration, process models can be published between environments through the import and export of releases. GT-X provides a default lifecycle management process, which is delivered as a modeled GT-X business process. As a result, organizations can adapt this model as required.

GT-X transparently supports multiple release variants of a process within a single environment. The release and, hence, version of the process is determined at runtime, based on role. Releases are published without the need for an environment restart, allowing the champion-challenging of pilot processes as part of continuous process improvement, without impacting vital production processes. Managers could then measure how each process variation is performing, and feed that back into analysis to improve the design.

The tools delivered within Toolbox are optimized to support the varying roles and different stages of the development lifecycle. Tools are task-oriented, incorporating a To Do List to facilitate the rapid development of robust and flexible systems. The To Do List functionality will automatically diagnose and validate a process under development, trying to work out what is potentially missing or erroneous. We understand this is currently being enhanced to support wider collaboration across the development team.

Hot Updates is a real-time edit debug mechanism. Developers use this functionality to alter the business process and immediately see the effect of the alteration in execution. This functionality (along with the Form development tool) could easily support live prototype demonstration sessions, with suggested changes made to models and then viewed immediately.
9 Monitoring, Measurement, and Management Information

Process Portal can record all actions associated with processes in the audit trail. This begins with an audit of each login, right down to the details of each process that the user has executed. Custom-built process models executing within the portal may also generate advanced audit data, with activities being associated with contact, party, event, case, external system, etc.

The process-oriented nature of the platform allows detailed measurement and reporting of business process activity. Business events and metrics can be defined by non-IT staff, and the resulting information can be viewed in various ways. These include real-time dashboard displays that integrate into the GT Process Portal environment. Dashboards might give “Traffic Lights” displays, to give an at-a-glance view of the status of a process or a team, and “Speedometers”, to indicate the performance of a process or team by a specific metric. The design of these interfaces is handled in the Forms tool, which can be linked to any GT-X process stage, or via Web Services, to external applications if needed (setting up a BAM-style application).

In development, the designer can identify “Significant Business Events”, which then tell the engine to flag the various event states, and feed the dashboard directly. Key Process Indicators (KPIs) are defined by measuring the time between two activities. It is also possible to configure dashboard components to aggregate measures across all instances and enable drill-down (for example, to open a view containing a list of all work items that are about to pass their SLA condition.)

![Contact centre dashboard](image)

Figure 7 - The Operational Dashboard can split activity by channel, incorporating both charts and KPIs

10 Templates and Frameworks

Operational Modules are fully functioning bundles of process templates, user interface screens and forms, data entities, and objects that support the accelerated development of business solutions. They cover Contact Management, Case Management, Campaign Management, Correspondence Management, Catalogue Management, and Account-Order and Payment Management. The Case Management template provides a solid basis for extension. It could be set up to handle multiple processes against a case, as well as virtually any other object modeled in the object-oriented environment.
11 Vendor

Founded in 1986 in Scotland, Graham Technology has offices in London, Galway (Ireland), Boston (USA), Eindhoven (The Netherlands), Sydney, Auckland, Johannesburg and Jakarta, with head offices in Glasgow, created to support a growing customer base in these countries. Graham Technology’s background grew from systems integration to the development of GT-X in 1993.

Total number of employees as at the end of July '05 was 221. Revenues for the year to March 31st 2005 were £15.255m ($27.5m). Around half of this revenue derives from professional services.

12 Cost

A range of licensing approaches are used, depending on client need and opportunity including a concurrent user model (perpetual license), enterprise-wide model, non-perpetual licensing models, and a transaction-based model. A proof of concept in pre-sales mode might start as low as $30K. Customer production systems are in the range of $100,000 to $10 million, depending on the implementation and services attached.
1 Product Overview

BizFlow is a robust application framework for developing process aware applications. It provides a rich set of process semantics that allow the developer to configure easily a wide range of options, including mechanisms for controlling the flexibility for users in the process, how they route work to others for input, who has completion rights, etc. A lot of this sort of functionality would normally require additional coding in other products.

BizFlow 10 (released June 2005) provides additional depth and support on the Integration front, offering a distinct BizFlow Integration Server that sits alongside the core process engine for long-running transactions, sophisticated data translations, and SOA support. Rather than integrate the two areas of functionality tightly together, HandySoft decided to keep them separate to enable the BizFlow server to stay as “light” as possible. (The core BizFlow Process Engine still incorporates comprehensive integration facilities.) Complementing the BizFlow Integration Server is the new BizFlow Integration Studio (BIS), which models the sophisticated integration level processes and service orchestration; BIS also complements BizFlow Process Studio, the existing integrated process modeling environment, which was designed for Business Analysts and end-users.

BizFlow 10 also introduces better support for more granular change propagation features (when processes are changed in flight). The new version also enhances the collaborative process design and the deployment and mechanisms for support of a more effective global workforce (time zone support, etc.). It features an embedded interactive reporting tool that complements enhanced process related metrics such as Global Process Variables and Custom Attributes.

BizFlow can also be configured to respond to system level events that happen outside the system – for example, by initiating a process in response to the appearance of a new file, attaching the file to the process instance, and notifying the appropriate user.

But perhaps the most impressive feature in BizFlow is the highly flexible and configurable user interface. Called BizCoves, these customizable, portal-ready Web interface components provide access to all BizFlow functionality, such as work initiation and process participation, ad-hoc reporting, monitoring, system administration, etc.

Other BizFlow features of note include a scalable process engine that can be deployed on both Microsoft and Unix platforms in a mixed cluster. A wide variety of administrator tools are provided to allow administrators to manage the entire environment. With support for SSL encryption and Public Key Infrastructure (including digital signatures and certificates), the firm can contemplate extending collaboration beyond corporate firewalls at minimal risk. BizFlow also supports single sign-on technologies such as Microsoft’s Active Directory. Interestingly, the product provides integration options for MS Project by supporting project related work, sending alerts, and ensuring appropriate completion of work by participants. A Visio import facility is also provided. Access to BizFlow functionality and folders is managed through a set of inheritable privileges granted to users at the individual and group levels.
2 BPM Engine

The BizFlow platform process engine drives work through the system, routing, monitoring, and escalating items according to the process models and rules established. The client layer includes a sophisticated set of User Interface components, Process Modeling and Forms Designer, and Administration facilities. BizFlow 10 introduces a separate BizFlow Integration Server (as part of the BizFlow Enterprise Edition), providing direct engine support for service orchestration and transaction management, data transformation, 2-phase commit, rollback, and exception handling. This is complemented by the BizFlow Integration Studio, which provides point and click features for developing services, modeling system-level transaction processes, and graphically mapping data transformation logic between services. For integration with IT resources, such as messaging, email, and database systems, BizFlow Professional Edition (without the Transaction Server) includes basic adapters (See the Integration section.).

![Diagram of BizFlow components]

Figure 1. BizFlow 10 will introduce a separate Integration Server to provide sophisticated EAI capabilities and support long running transactions

The BizFlow Process Server is based on an n-tier architecture divided into 3 distinct layers: the Web-Server Layer, the BizFlow Server Layer, and the Database Layer. Each layer is scaleable, handling multiple processors or machines to match the load requirements. The BizFlow Server Layer contains its own transaction and integrity management mechanisms. Written in C++, the system is then exposed via Java, Microsoft COM, SOAP, and native C++ API interfaces. The core components are (See Figure )

- **Process Engine** – Creates process instances upon request, evaluates routing conditions, creates work items for each participant, completes work items upon requests, performs automated activities, such as sending emails, manipulating data in the database, interacting with 3rd party applications, creating messages into third party Messaging Oriented Middleware (MOM), getting messages from MOM, and so on.

- **Request Dispatcher** – Receives incoming requests to BizFlow; processes synchronous requests (through interaction with the Process Engine and other components); and stores asynchronous requests into Queues.

- **Scheduler** – Manages all time-based events, such as checking on deadlines and invoking alerts.

- **Queue Engine** – Processes asynchronous requests. This is subtly different from the mechanism of the Message Adapter (See below). The Queue Engine allows interactions with other applications or services at the file level; for example, a newly created file initiates a new process.

- **Authentication and Access Control** – Validates user logins (either independently or against configured authentication servers); checks access permission on requested objects.
• Form Engine – Provides centralized forms repository management, servicing forms (including rendering forms in HTML, processing server side scripting, data processing, and so on), and database connection pool management.

Figure 2. The BizFlow Process Server Architecture

Complementing these core components are a number of adapters that support interaction with other applications and the file system:

• Event Response Adaptor – Observes configurable events, such as file arrival, email arrival, data changes, and queue message arrival; performs configured system actions, such as initiating new process instances, and completing work items or wait activities.

• EJB and Web Service Adaptor – Retrieves a list of EJB/Web Services and their required parameters, calls the EJB/Web Service with values from process instances, and returns the results back to the corresponding instance.

• PKI Adaptor – Interacts with Entrust PKI server to support form data and attachment encryption and decryption.

• Message Adaptor – Interacts with Messaging Oriented Middleware (MOM), such as IBM WebSphere MQ and Microsoft MQ.

• Scripting Adaptor – Executes business rules written in Java.

• LDAP Adaptor – Imports users, user groups, and organizational structure information from LDAP into BizFlow Authentication, and updates the information periodically. It also performs authentication of a user against an LDAP server.

• Common EDMS interface is a publicly available tool kit for development of additional EDMS adaptors, consisting of around 20 base functions that utilize or store attachments in EDMS environments.
At the level of the Web Application Server, the system provides support in three areas, as detailed below, underpinned by a Java API and the Base C++ API set.

- **End User Interfaces -** Servlets, Beans, and JSP-based web application for various types of work list presentations for each user, process definition list, process instance list, and process archive list.

- **BizCoves and Reports –** Provide a portlet-like view of work list that meets certain criteria. They are also portable into other portal environments. Reports include benchmark, statistics, and performance of processes and activities. Additional custom reports are supported.

- **Administration interfaces –** Servlets, Beans, and JSP-based web application for management of users, user groups, organizational structures, access controls, folders, licenses, server configurations, calendars, event observations, and so on.

- **Database Layer -** The Database server layer stores BizFlow process instance information and allows access by multiple BizFlow servers at the same time. It handles interaction with control data stored in the database and the file system.

With BizFlow 10, HandySoft has extended its Web Service support. Of course, Web Services can be used to integrate with some external applications. Processes can also be published as a Web Service, and processes can consume other processes that have been published as Web Services. This enables flexible process architectures, independent of the usual mechanism for calling subprocesses. But the biggest change with BizFlow 10 is the ability to orchestrate Web Services into “transactions” using the BizFlow Integration Server. Transactions can be constructed to call multiple Web Services or Java, presenting them as a single atomic service to the rest of the Process Engine.

### 2.1 Platforms

The BizFlow server supports multiple platform environments, including Microsoft Windows Server 2003, 2000 and NT4, AIX, HP-UX, and SUN Solaris. The BizFlow server layer may consist of a mix of these platforms. Further, no 3rd party Application Server is required to run the BizFlow server. Supported Web Servers are Apache Tomcat, BEA WebLogic, IBM WebSphere, and Sun ONE.

BizFlow utilizes file storage and relational database (supporting MS SQL Server 2000, Oracle 8i or 9i, or DB2 UDB 7.2) to store process-related data.

### 2.2 User Interface

The Work Area, accessible upon user login through the single web-based user interface, enables participant access to work. Users can start processes, view reports, generate reports, view the status of executing processes, and configure user properties such as out-of-office dates and to whom work should be sent during absence.

BizCoves provide an alternative way to view information within the user interface. BizCoves consolidate the entire work area into a single point of access. BizCoves are containers that provide at-a-glance access to work items (and functionality to handle them), management and administrative tools, process monitoring capabilities, and reporting tools.

Completely web-based, BizCoves are highly configurable portal plug-ins (Portlets), providing both list and tabular views. They allow individuals to organize their work into categories that make sense to them – grouping work by case, time, priority, or whatever combination of items that meet the user’s needs. Although not yet JSR 168 compliant, this functionality will be in a future BizFlow 10 point release.

For example, a departmental UI might be set up so that reports are organized by project, and commonly accessed departmental processes are grouped together – for example, timesheets, expense reports, etc. A BizCove for a claims examiner might display claims assigned only to his or her office, with another
BizCove used to display claims that can be processed by any office. At the end-user level, the portal display can be further customized through the use of filters to display only information that fulfills specified criteria such as, viewing only medical claims.

There are a variety of BizCove types. These include BizCoves for process initiation, work lists, monitoring, and reporting. Any one or any combination of the BizCoves can be displayed in the BizCove Work Area, with each type serving a different purpose. BizCoves are easily integrated into existing Portal environments such as Microsoft Sharepoint, Hummingbird, or PlumTree.

Once a work item is opened up, the product launches a “Workitem Handler” to present the content. This is the main working environment for users to view and enter data, get instructions, complete a work item, make attachments and comments, and so on. BizFlow provides three different types of Workitem Handler. The Basic Workitem Handler is a pure web browser-based application with limited functionality. The Enhanced Work Item Handler is a feature-rich, downloadable application installed on client machines (similar to Adobe Reader). The Accessible Workitem Handler provides keyboard only navigation function for disabled people (508 Compliance).

Workitem Handlers usually present a number of Tabs, each related to a different application that is needed in order to complete the work item. The developer can set parameters to ensure that the user has actually viewed or completed these items before marking work as complete. Effectively, the Workitem Handler provides a mechanism to bind multiple applications to a single activity.

2.3 Scalability

BizFlow has been designed to operate in a highly scalable environment to support very high volumes or transactions. Performance testing with regards to user transaction throughput has yielded results of over 60,000 transactions completed per hour, or 17 transactions per second with 10,000 simultaneous users.

The BizFlow databases allow for a clustered server environment to ensure maximum redundancy and fault tolerance. The Server can also be replicated and clustered in a hot stand-by situation. Of course, it is also possible to distribute the process logically to break up high volume transaction processing situations.

Failover features in a clustered BizFlow server environment ensure that processes remain operational – eliminating data corruption and reducing data loss – even if one or more servers is not operational. In a global deployment, with multiple clustered BizFlow environments, processes between sites can be
configured to ensure integrity and automatically transfer operation to other servers, processes, or site locations in the event of a server failure. Clustered BizFlow server environments are supported through load balancers between any BizFlow server components. BizFlow also reliably handles network interruptions and other externally caused interruptions without data loss or corruption, with processes continuing to execute successfully once an environment is stabilized.

3 Processing Modeling

BizFlow Process Studio enables both business users and IT staff to create process models by dragging and dropping activity icons and transition arrows onto a palette. Using various property editors and dialogs, developers configure the various types of activity, participants, deadlines, transitions, notifications, delegation rules, timers, database accesses, routing, and branching logic, etc. BizFlow delivers this functionality without requiring programming skills on the part of the process designer.

![Figure 4 The BizFlow Process Studio environment](image)

Now, with BizFlow 10, the BizFlow Process Studio (built within Eclipse) incorporates a comprehensive collaborative design and deployment environment for project teams. While a web-based development client works well for small project teams or individuals, enterprise-level development teams need more functionality. HandySoft has returned to an interactive, feature-rich client for development, to better support the collaborative, project oriented approach to development and deployment, enabling enhanced control over how BPM projects are run. When setting up a new process development project, it is possible to assign a project manager, multiple designers, and a publisher. Check-in and Check-out control over objects associated with the project enforces configuration management policies. Once developed and everything is in a publishable state, then the publisher controls the deployment to the live environment. A Guest role allows other project teams to see components and forms under development (inside of the project). They can then copy these components into their own projects and modify them there (or reference the component inside the original project).

In addition to the Start and Stop activities, there are different kinds of steps in BizFlow to reflect the needs of the process: Normal (human interaction), Sub Process, Queue, Mail, Component (EJB-Web Service), Agent, Wait, SQL and Connector. Each activity type fulfills a distinct purpose.

Along with the usual routing options to user group or individual user, come automatic options to route the work item to the initiator of the process, the last participant of the preceding activity, and even the same as the preceding activity. Routing selection can also be made via process variable or through relationship rules based on user, initiator, or participant of the previous activity. The choice of rule...
includes manager of the selected participant, the manager of the manager of the selected participant, peer of the selected participant and organizational unit member with a specified job title. When assigning work to a user, the developer also has the option of having the engine select the most appropriate user based on current workload of members of the group.

There are a large number of other process nuances that are configured directly within the BizFlow Process Studio. These include options to create one for all the members of a specific group. The system can then be set to move on only after all participants have completed their work. Alternatively, it could be set to move on after just one has completed it.

As mentioned earlier, BizFlow further allows the import of MS Project files and Visio basic shapes, generating BizFlow process models from existing files. When importing a Visio file, BizFlow is consistent in the way the objects of the Visio diagram are converted to Process Designer components. All basic shapes are matched to activities. Arrows are converted to transitions (double arrows are converted to two transitions - one in each direction).

Direct integration with Microsoft Project enables BizFlow to more easily support project oriented working. A BizFlow process definition is rapidly built based upon an existing Microsoft Project plan. This can be at whatever level of detail that makes sense for the needs of the project. BizFlow then ensures that project deadlines are met as it automatically distributes tasks to the correct participants, sending alerts where appropriate to keep the project moving. It also allows the Project Manager to oversee the status of work in the entire project and ensure that critical tasks are properly handled.

Depending on the options used, the entire project or just parts of the Work Breakdown Structure can be imported. A Microsoft Project database option allows for the automatic update of status information from BizFlow when applicable activities and sub-processes are completed (or partially completed). This makes it possible for the Project Manager to continue using Microsoft Project for planning and reporting purposes.

Further, the system can be set up to create two BizFlow activities for each task in MS Project. One is assigned to the participant responsible for completing the work. The second is assigned to the Project Manager. Once the participant completes an activity, it goes to the Project Manager for approval. If needed, the Project Manager has an option to send the work item back to the team member.

BizFlow follows the WfMC's standards for process modeling. Process models and logic are stored in Wf-XML and XPDL formats. BizFlow was recently one of 4 vendors to prove interoperability between Wf-XML 2.0 and the OASIS ASAP standard. Full BPMN support will be available next year including compensating transactions. We understand that support for BPEL is also planned over the next year in BizFlow Integration Studio.

3.1 Subprocesses

The Subprocess activity type is used to call other process definitions. Any process on any accessible server can, theoretically, be called as a sub-process. When BizFlow calls a sub-process, it invokes the application together with its parameters using SOAP and Wf-XML as the connection protocols. Since BizFlow can publish and consume a process definition as a Web Service (using a component activity type instead of a sub-process activity), it is also possible to use Web Services to handle sub-processes.

Sub-processes can be called synchronously or asynchronously – i.e. depending on how the process is called, the parent either continues on or waits for the sub-process to complete. Of course it is possible in the parent process to set up conditions upon which the sub-process is initiated.

3.2 Shared Data Space

BizFlow supports a wide range of Global, definition, and instance level variables including a variety of arrays and applications – available types are String, Number, Participant, Application, Date, File, String
Array, Number Array, Participant Array, Application Array, Date Array and File Array. Variables may be set to public (shared between parent/sub-processes and other processes) or private (internal to the process definition and not shared).

BizFlow 10 introduces a concept known as “Custom Attributes”. These are used for classification purposes but are not generally used directly within the process model. They are useful for collecting information about the process that might be used for audit or documentation. For example, assigning a cost centre, which could later be used to filter or search on later. This would allow a business manager to develop BizCoves that report or monitor by cost center codes.

### 3.3 Forms

BizFlow Forms Designer facilitates the creation of new electronic documents, providing features such as electronic signature fields, calculation and database fields, script libraries, HTML rendering, etc. Using the File variable type, it is possible use an XML file as a process variable. When that same file (schema) is mapped to a BizFlow Form, it populates the information from the XML file into the Form directly. BizFlow also supports Web forms in HTML, JSP, and applet format.

In a sense, BizCoves are forms that are designed to give users information on, and rapid access to, work in the system. They are designed to organize and simplify the way people work. BizCoves are developed using a wizard interface that walks the developer (or end-user) through the many different types and their options.

![Figure 5. BizCoves are configured using a sophisticated set of wizards](image)

BizFlow also supports existing electronic documents as attachments (e.g. Word, Excel, InfoPath, Adobe Acrobat or any other preferred format). These are accessed in their native format or via an optional viewer that provides annotation, zoom, print and multi-page support. Attachments are stored at either the file system level by BizFlow or via 3rd party EDMS environments such as Hummingbird, Documentum, and Microsoft SharePoint.

### 3.4 Time

Activities in a BizFlow process have schedules set for waiting time, work time, and deadlines. Schedules can be set based on a fixed time period or time relative to a variable (or the initiation of the case). One of the relatively unusual (and useful) features of BizFlow is that it has mechanisms to drive deadlines and the escalation of work before critical events occur. When setting deadlines, the designer can specify
the lead time for an activity. And that deadline might be dynamic based on some process variable. As a result, the Scheduler (in the core BizFlow Server Platform) can handle lead and lag notifications and dependencies. Configuring email notifications at certain events is straightforward. Notifications pull information from the SDS and customize the email for the case in hand.

In the BizFlow Process Studio tool, the Time Calculation function adds up the time defined for each activity to arrive at a total for the entire process definition. This allows the designer to quickly assess how much time the process or a part of the process requires.

3.5 Process Optimization and Simulation

Process Analyzer (part of the BizFlow Process Studio) provides an easy-to-use environment for describing business conditions, working patterns, cost, revenue, workload balancing, instantiation patterns, work item characteristics, etc. The aim is to enable the analysis of processes to discover inefficiencies, test improvement strategies, set return on investment expectations, or change the way the firm does business. The tool offers customers the ability to customize “what-if” scenarios that consider specific policies, procedures, distributions, probability profiles, and so forth. However, the actual process model used for the simulation is not the same as the process model for BizFlow process engine.

With Process Simulator, companies can use actual management policy when evaluating their processes and attempting to make them more efficient. For example, a manager can test an improvement strategy that involves splitting and overlapping shifts, sharing resources with other departments over weekends, and only utilizing the most highly skilled supervisors to handle customers with 2 outstanding reviews.

Process Simulator also offers an optimization capability where the modeler states a business goal (e.g. maximize throughput volume per week), identifies constraints and variables (e.g. the number of resources is fixed, but their working hours are flexible). The optimization engine will then return the “best case” configuration to meet that goal (e.g. the best mix of resources to maximize throughput volume…for example, 15 people to handle peak volume Monday, 8 people + 2 stand-by personnel on slow-volume days).

4 Business Rules

BizFlow provides a point and click editor for creating transition/process flow rules (if-then-else type rules) and it also supports deadlines, time-based event rules and exception handling. Where necessary, access to a Java programming environment is available for very complicated business rules. If needed, the product is readily integrated with third party Rules Engine vendors such as Corticon and ILOG (via Web Services and EJB integration).

The semantics of the process activity itself are also readily extendible through business rules. Each activity has both “In and Out Conditions”. These conditions must evaluate to true before work can move on, or as it goes into the Work Item Handler. Effectively, this sets up another layer of business rules on the process.

5 Integration

In BizFlow 10, integration capabilities have been significantly enhanced with the addition of the BizFlow Transaction Process Server and the corresponding BizFlow Integration Studio modeling environment. These two components supplement the existing integration capabilities of the BizFlow Process Server (sold separately).

The goal for a user of BIS is to create a “Business Transaction”. Think of a business transaction as a system-to-system process flow containing services that perform units of work and exchange data, along with routing/flow logic (e.g. Do While, Loop, Repeat, etc.). Within the business transaction, a developer can define checkpoints for two-phase commit and rollback purposes, exception handling, scheduling
and deadlines, and data transformation rules. At runtime, a business transaction can also be monitored similar to a business process within BizFlow.

Within the BIS, development follows a methodology similar to this:

- Data schemas to support the desired complex transaction are defined within XML Spy or other XML Schema data definition tool; these schemas are imported into BIS.
- Developers then create “data maps” through drag and drop GUI tools to define transformation rules between schemas.
- Developers create one or more services to handle the reception and delivery of messages within a transaction. A broad set of packaged functions are provided out of the box to support rapid service development including “listeners” for email, FTP, HTTP, UDDI and RosettaNet. BIS also provides packaged adapters for BizFlow, SAP R/3, and Web Service adapters to facilitate system integration.
- Once the data schemas, maps, and services are created, the developer orchestrates these components into a business transaction, complete with flow logic, exception handling, and monitoring capabilities.
- The business transaction is then available to be called from a higher-level business process defined within BizFlow Process Studio using a “component” activity. Data schemas from BIS are imported into BizFlow and mapped to process variables.

While this sort of sophisticated support will appeal to many large enterprises with significant systems integration issues, the services provided in the core BizFlow Business Process Server will be sufficient for less ambitious projects. A number of key adapter interfaces are provided within the product to facilitate integration of third party applications. As described in the BPM Engine Section on page 3, BizFlow provides an EJB-Web Service Adaptor, PKI Adaptor, Scripting Adaptor, and LDAP Adaptor.

BizFlow supports the development of custom-built or vendor-provided native adapters for mainframe, legacy, and enterprise applications through the BizFlow “Agent” activity type.
The product also allows integration via a “Queue” activity type. An enterprise legacy system can then retrieve information from the queue, enabling integration at the information level across platforms and applications. The same mechanism can be used to reduce server congestion, increasing overall system efficiency and capacity through the use of multiple servers. The message queue managers that are supported include IBM MQ Series and Microsoft MQ.

For document management systems, functionality is provided for Hummingbird, Documentum, and Microsoft SharePoint. For other EDMS systems, an EDMS adapter development kit is available that contains code and documentation supporting custom development.

The Event Response Adaptor completes the picture, providing the capability to integrate virtually any other application at the file or data level: It observes configurable events, such as file arrival, email arrival, data changes, and queue message arrival, and performs configured system actions, such as initiating new process instances, and completing work items or wait activities.

A “Common API” exists at all 3 levels, delivering access to BizFlow functionality at each level. This API is wrapped with a Java Servlet Server to provide Java-based access to the Common API.

6 Organizational Structure

Out of the box, BizFlow imports any existing LDAP directory information to reflect the structure of the organization. Effectively, this information represents the business units or departmental structure of the firm, each with its employees, management, and the reporting relationships. Separately, BizFlow supports any number of additional hierarchical structures and stand-alone groups (roles). Administrators can then assign individuals and groups to those hierarchies. As a result, it becomes possible to represent just about any organizational form or matrix reporting structure across the firm.

Using these mechanisms, process designers can route work to the relevant user whether that be an organization unit, user group, individual user, or even a system. Moreover, they can easily configure the process to determine dynamically a person’s manager or peer, and route work to them automatically. Since processes are linked to a default hierarchy, subprocesses can maintain separate routing rules from the parent process.

BizFlow is configured with six default “authority groups”: System Administrator, General Administrator, Designer, Business Administrator, User, and Limited User. The system administrator can then create new authority groups, and modify the access permission associated with them. Any additions and modifications that are made to authority groups are reflected immediately in the Authentication Manager. Changes to access rights are reflected immediately in the Folder Access Manager.

With BizFlow 10, HandySoft has introduced a number of additional features to support the global work force, including shared calendars, support for different time zones, working periods, and national holidays. The product can also synchronize with multiple LDAP Directories simultaneously.

7 Process Adaptability

BizFlow supports real-time monitoring and dynamic alteration of process instances. When a process is instantiated, the process definition is copied and associated with the new process instance. These definitions are stored using the WfMC XPDL interoperability standard.

As a result of this approach, suitably authorized users can change a running instance without affecting others. In BizFlow 10, HandySoft has implemented support for change propagation; having made changes to an instance, a user can then selectively go through and apply that change to other instances that are based on that same definition. This change propagation feature is unique in the market place (at least compared with the other products we have reviewed for this report).
With the flexibility of the BizCove user interface and process variables, it becomes relatively straightforward to construct a case handling environment. With a case handling approach, the focus of activity is on the overall case of work, with any number of processes instantiated to support the needs of the work in hand. It is also possible to take a subtly different approach where a single process coordinates the process, with viable subprocesses populated dynamically into an array for later instantiation.

BizFlow also supports ad-hoc work routing, with a series of associated rules for returning ad-hoc routed work back into the normal flow cycle. Ad hoc routing lets the user designate someone else to handle the work item. Alternatively, the work item could be routed to different users for input or review (in parallel, or serially) prior to the work moving on to the next activity in the process definition. In the Workitem Handler, the original user can define the options and rules that must be followed, even down to ensuring that the work comes back through the original user before it is marked as complete. Ad hoc routing can be enabled by default for all normal activities in a process.

8 Process Lifecycle

With BizFlow 10, HandySoft has focused on the needs of the BPM project team. The publication and deployment of the set of process definitions and models is controlled by a publisher role in the project team. Alongside that is the control over process definitions themselves through the associated document management features of the product. To modify an existing process, qualified users must “check out” of the underlying model. When it comes to checking back in the process description, if the change is to a process model that has instances running in the system, then the change propagation feature allows the user to control the process instances where the changes will apply (discussed under the Process Adaptability section).

9 Monitoring, Measurement, and Management Information

BizFlow provides visual monitoring and management capabilities for work in the system. Suitably authorized users can click on a process and discover its status through a graphical view, drilling down into specific details around activities to view history information (e.g., who approved a decision or what information was added).

Process Monitoring is also supported via reporting within the BizCove user interface framework. Out of the box, BizFlow supports benchmarking, status, workload, throughput trend analysis, and ad-hoc reporting capabilities – supporting diverse information needs from executive level reporting to technical support troubleshooting. These report categories provide point-and-click report generation wizards that produce adaptable ad-hoc, graphical, and data export capabilities through the web browser. At runtime, this information can also be exported to Microsoft Excel.

In BizFlow 10, developers and end-users can build, for a group of users, a report list that specifies the reports that can be invoked directly from within a BizCove. While all data is stored in the BizFlow database, it is accessed and displayed via Crystal Reports, allowing the user to drill down into underlying information detail. Further, users can now aggregate process data across all processes that share a common process definition.
Using these sorts of features, managers can closely monitor current work in the system. With care, virtually any sort of performance measure can be captured and presented. Where relevant, active alerts linked to process models can warn of looming deadlines before they are passed. Most other BPM products struggle to support this sort of lead-time functionality.

10 Templates and Frameworks

The core BizFlow product is used as the foundation for the following associated products:

- HandySoft’s SOXA Accelerator solution for Sarbanes-Oxley compliance and enterprise risk management. The SOXA Accelerator automates data collection with secure, easy-to-use forms, supporting collaboration between project participants throughout the enterprise and with auditors.

- HandySoft’s Accounts Payable Accelerator application automates AP tasks, reducing errors and expense, and providing the reports and data needed to ensure quality performance.

BizFlow also provides a wide variety of starter templates for Government, Finance, and HR applications. These include over 40 government forms, Correspondence Management and Tracking, Sales Order Management, Product Fulfillment, Travel and Expense, Procurement, Capital Acquisitions, Accounts Receivables, New Hire, Engineering Change Management, and Benefits. In the Insurance/Financial Services arena, applications are available for Worker’s Compensation, Agenda Development, New Business (Life), Annuity New Business (Life), Default Loan Management, Mortgage (loans) processing, and Tax Management.
HandySoft Global

11 Vendor

HandySoft Korea was founded in 1991. It is a publicly traded Korean company with around $40m in revenue and 230 employees. HandySoft Global is a pure-play BPM company established in 1998 and is incorporated in the state of Virginia and now has over 100 employees in development, sales, and marketing. HandySoft Global was formed by HandySoft Korea to take existing intellectual property from years of workflow experience and create a world class BPM product known as BizFlow. BizFlow is sold by HandySoft Global and over 50 approved distributors worldwide with 250 customers in over 20 countries. A little over half of the group revenue is attributed to BizFlow.

12 Cost

HandySoft uses an Enterprise License model. The standard licensing price is based on the number of seats, and can vary greatly from customer to customer. There are additional charges for integration adapters. The average sale is around $150,000.

BizFlow Standard Edition ($85,000) is HandySoft’s minimum purchase base package, comprising 100 Named User Licenses, 2 Administrator Licenses, 3 BizFlow Process Studio Designer Licenses (Standard), and standard maintenance for the first year.


BizFlow Evaluation Edition ($25,000) provides a 12-month (non-renewable) limited license and limited maintenance agreement for evaluation purposes. It includes 20 Named User Licenses, 1 Administrator License, and 1 BizFlow Process Studio Designer Licenses (Standard), along with a first year maintenance agreement (no upgrades).
IBM WebSphere Business Process Management

Version 6.0

UPDATED

IBM
Route 100
Somers, New York 10589
Check IBM site for phone and fax numbers in your area.
http://www.ibm.com/contact/us/

1 Product Overview

IBM sells a BPM product suite under the WebSphere brand for business process management. The various products can be used separately or in combination, which enables organizations to model, assemble, deploy and manage business processes and overall company performance.

Several of the BPM suite products described in this report situate their products on top of IBM's WebSphere application server and will, increasingly, incorporate other of IBM's WebSphere BPM products into their offerings. Thus, IBM is active in two markets. It is playing in the BPM Server space, supporting other vendors' BPM products, and it is active in the BPM Suites space, offering a series of IBM products that can be combined to provide a company with a complete BPM suite. The key products in the IBM WebSphere BPM suite include:

- **The IBM WebSphere Business Modeler** (WB Modeler) version 6 is a business analyst tool which is used to define, model, simulate, and improve on business processes. This tool helps business analysts define and optimize their processes, while justifying process changes through return on investment (ROI) calculations. It is an open standards-oriented product, operating on the Eclipse Integrated Development Environment (IDE). WebSphere Business Modeler products can drive more granular business insight and knowledge by thoroughly and visually defining those business tasks which are critical to your firm’s ongoing success.

- **WebSphere Integration Developer** (WID) version 6 is a development tool supporting assembly, debugging, and deployment of services into process flows. It is also used for the construction of mediations with WebSphere ESB and also generations of adapters to a wide range of business applications for end-to-end integration. One tool, one set of skills offering rich capabilities. Knowledge of Java coding is not required for using this drag-and-drop tool interface. It is also complementary to Rational Application Developer, which is used to develop Web services.

- **IBM WebSphere Process Server** (WPS) version 6. WPS is at the heart of BPM. It is the high performance business engine that executes your mission critical business processes, securely, consistently and with transactional integrity. Whether automating processes in the factory, processing claims and financial payments, executing an efficient supply chain or ensuring compliance with the latest industry regulation, WPS orchestrates the assets of your business to form highly optimized and effective processes to meet the goals of the business. WPS is a comprehensive software product combining the features of its predecessor products into a single scalable platform providing process integration, workforce management, and enterprise application connectivity. It also incorporates WebSphere Enterprise Service Bus, which provides messaging and mediation services callable within Process Server and a WebSphere Partner Gateway license.
• **IBM WebSphere Business Monitor** (WB Monitor) version 6.0 is a real-time monitor that utilizes visual dashboards to provide a dynamic view of business processes for improved business decision-making. This tool gives you the window into your business process performance. It enables you to monitor business processes in real-time, providing a visual display of business process status. Alerts and notifications sent to key users facilitate continuous improvement of your business processes. The customizable dashboard implemented as WebSphere Portal pages are visually intuitive, featuring scorecards, key performance indicators, and gauges.

• **WebSphere Partner Gateway** serves as a connector between global trading partners and other businesses via electronic data interchange (EDI). It enables business communications by transforming data between ROD, XML and EDI formats.

• **WebSphere Adapters** discover information and processes held within business and applications and expose them as a set of reusable services. Adapters coordinate inbound and outbound flows of information between applications and the service requester. With a wide range of pre-built adapters for ERP (SAP), HR (PeopleSoft/Oracle), CRM (Siebel), supply chain systems, and many other applications, customers can drastically accelerate their “time to value.”

As mentioned previously many of the capabilities found in earlier products such as WebSphere MQ Workflow (formerly MQ Series Workflow), WebSphere Server Foundation, and WebSphere Interchange Server are now embedded in WebSphere Process Server, and have been available for years. Others have been redesigned to function within a BPM environment, and still others are essentially new products developed for the BPM market. More important, IBM is defining an infrastructure that will tie all of its BPM offerings together. Simultaneously, it is working with others to create BPM standards (e.g., BPEL, etc.) to assure that IBM customers’ and partners’ BPM solutions will integrate with IBM’s and other vendors’ BPM products. Existing BPM Suites, to the degree that they define their internal infrastructure and interfaces, do so only in a causal way, since they really are not designed as a set of BPM components that a client might pick and choose. IBM has consciously designed a BPM environment with open, well-defined programming interfaces and standards so that companies and partners can deploy a BPM Suite that addresses their specific needs and allows them to extend it as their needs change. Thus, IBM joined with BEA and Microsoft to propose the BPEL4WS (BPEL) XML business process language. Similarly, IBM is working with other companies at the Object Management Group (OMG) to develop a business process metamodel and a business rules metamodel, and is working with BPMI.org to develop a BPMN notation that can be used with BPEL. Service Component Architecture (SCA) is also another example of how IBM has led and collaborated with others to drive towards standards as part of an SOA programming model. In addition, IBM has developed an Events standard that it plans to submit to a standards body that will simplify the interface between BPM servers and BPM monitoring products. Thus, IBM is not only developing BPM products, but it is simultaneously working with user organizations to develop the standards that companies will use to integrate various BPM products.

Readers should also be aware that IBM is continuing to invest in its BPM offering. IBM executives have given several briefings over the past 6 months, and, in the course of those presentations, the list of products within the IBM BPM offering has increased. We have tried to use the latest list, but fully expect that some will change in the future, as IBM continues to work with customers to further define the benefits of a holistic BPM approach.

### 2 BPM Engine

Figure 1 provides an overview of how the various IBM BPM products fit together. The figure shows the three basic IBM WebSphere BPM products we are considering in this report, as well as several related products that a company might use.
IBM’s BPM engine is WebSphere Process Server. IBM recognizes that different processes require different kinds of capabilities. Thus, IBM uses BPEL to execute the flow of processes that orchestrate resources. Although the current version of BPEL does not directly support human interactions, this is not a problem as comprehensive human task support within WebSphere Process Server is represented as a service in the process flow. Process Server also provides an extensible architecture to allow third-party plug ins such as business rules management systems. IBM's WebSphere Process Server combines the capabilities of multiple BPM engines that users can choose from, depending on their needs. The entire IBM WebSphere Process Server is based on IBM's market-leading WebSphere application server, on J2EE, and on Eclipse.

2.1 Platforms

IBM products run on Windows, Unix, and Linux and work with all major databases (DB2, Oracle, etc.). IBM’s products are designed to utilize the entire range of Web Service standards, including XML, SOAP, UDDI, WSDL, and BPEL, all of which it helped create. IBM supports J2EE containers, JMS and JSP.

2.2 User Interface

Any BPM product must support a variety of interfaces. Some interfaces support employees, some support modelers or developers, and still others support managers or supervisors who monitor the execution of business processes. IBM’s different products have a variety of interfaces. Many, including WebSphere Business Modeler and WebSphere Process Server have written in Eclipse, an open J2EE development interface that provides a consistent environment. IBM’s Rational XDE is also based on the Eclipse platform, so developers moving from WB Modeler to Rational XDE, for example, will experience a similar interface.
The WebSphere Business Monitor is a server-based product (housed on a box) that closes the loop on Business Process Management, by allowing customers to see how long it takes for certain business processes to complete by flowing through various users, work cycles and departments. The Monitor offers both real-time and historical views that enable users to view and take action on business processes as they happen live. Customers can utilize the real-time performance data pulled from WebSphere Process Server; event flow data from WebSphere ESB or Advanced ESB Message Broker; and non-process data from database tables, and loop it all back into the front-end BPM Workbench (which is based on Lotus) for further manipulation and testing. Changes can be made on the fly, which provides a crucial time/cost advantage.

The WebSphere Business Monitor 6 consists of two components:

- **The Workflow Dashboard** monitors not only the data and audit trail of Process Server (the WebSphere MQ Workflow components), but also ESB (formerly known as WebSphere Message Broker) event flows and non-process data from certain external databases. (Note that the newly-released Process Server extends coverage to support direct monitoring of event flows from the WebSphere InterChange Server component. The workflow dashboard provides process administrators with a detailed operational console of the business process as it functions. Specifically, process managers are empowered to track and determine performance levels of employees, organization units or entire processes, and to perform load balancing, as necessary.

- **The Business Dashboard** provides a higher-level, more strategic view of business processes than the Workflow Dashboard. Custom reports can be generated utilizing current or historical activity performances, employee workloads and bottlenecks. The Business Dashboard is designed as a decision making tool for line-of-business management, allowing tactical problem solving on the fly. While the Workflow Dashboard provides intricate details on the business process, the Business Dashboard provides business statistics reporting by comparing comprehensive, actual metrics to established performance measures. Additionally, the Business Dashboard locates and measures the cost of work items that match particular criteria. Archived historical business metrics also play a valuable role in proactive decision-making in real-time. Users can display business process statistics as graphs, bar charts or pie charts for easy understanding of process performance. Users can also set-up performance alerts or Key Performance Indicators (KPIs). This means when processes drop below the level the user has set, they will receive an alert so that they can go in and improve the performance of their processes.

Figure 2 illustrates a screen developed with WB Monitor.

**System Administration and Security.** IBM has an extensive set of system administration and security utilities that are available to anyone using IBM’s BPM environment.

**WebSphere Service Registry and Repository.** IBM has significant new and enhanced product announcements to support creating and reusing services. The WebSphere Service Registry and Repository (WSSR) provides:

- A service registry that contains information about services (also called meta data), such as the service interfaces, its operations and parameters.
- A meta data repository that has the robust framework and extensibility to manage information about the usage of the services.
Some of the highlights of this newly announced product include:

- Publication of service endpoint capabilities: As a service registry, it manages meta data about the services. One of the purposes of the meta data is to describe the capabilities of each service. The registry collects the meta data, manages it, and makes it available to users who need to know what the end-point capabilities of a service is.

- Locating and subscribing to the services: As a manager of services and services information, the WSRR facilitates the discovery of services in an SOA. It also notifies users of changes to services, such as version changes, that they are using. These features are useful through the lifecycle and encourages services reuse.

- Policy management: Because the WSRR serves as a key interface between the users and providers of services, it is ideally suited to enforce the policies and SLA’s. This promotes the optimal use of services, encourages reuse of services assets, and enables proper governance of an SOA.

- Interoperability across other registries and repositories: The WSRR can be integrated with other registries. This integration helps ensure that you have a unified view across a variety of service information sources. WebSphere Service Registry and Repository supports federation of multiple registry repositories and other standards to help maximize security and portability.

**SOA Business Catalogue.** The SOA Business Catalogue is an online repository showcasing IBM’s and its partners’ product extensions, value-add and industry specific assets. It supports a large eco-system around IBM’s business centric view of SOA. Predefined process templates, adapters, toolkits and many other items are available for download or purchase.

**BPM Repository.** Because IBM’s BPM environment is comprised of a number of separate products, there are a number of repositories involved, each repository maintaining data relevant to the product. Tivoli keeps event information in its own data repository. IBM’s WB Modeler maintains data in its own
repository. Similarly, any Business Rule Engine that a company might use will maintain its own rule repository. If a customer wants to create a common warehouse for, say, historical analysis, they can use DB2 Universal Data Base to create such a warehouse.

**Linking Everything Together.** At several points we have suggested that IBM is supporting open standards to assure that its products and its partners’ products can be integrated without difficulty. When existing open standards are combined with new metamodels being formalized by the OMG and other open standards, like BPEL and the Common Base Events standard, being formalized by OASIS, one can see that IBM is working to create an environment that facilitates linking not only IBM tools and products, but a wide variety of different tools and products into a common BPM environment that a company can standardize to meet its specific needs. SCA for example is seen one of many steps to defining standards for an SOA programming model.

### 2.3 Scalability

IBM’s BPM engine is based on WebSphere MQ Workflow, a component of the new Process Server which has been used in large enterprise environments for many years. IBM’s largest customers routinely deploy IBM BPM products in complex enterprise environments.

### 3 Processing Modeling

Over three years ago, IBM acquired Holosofx, a Business Modeling product vendor that had established a superior integration with IBM’s WebSphere MQ Workflow offering, and was respected for its superior process monitoring capabilities. Since then, IBM has enhanced the Holosofx product, increasing its functionality and has rewritten the product in the Eclipse software development environment. The new business process modeling product is renamed IBM WebSphere Business Modeler (WB Modeler).

Figure 3 pictures a WebSphere Business Modeler screenshot with a process diagram. WB Modeler supports portions of BPMI’s BPMN notation. WB Modeler generates both BPEL and FDL. Thus, by changing a flow model in WB Modeler, one can change the sequence in which the activities in a process occur, as managed by IBM's Process Server. WebSphere Business Modeler is used across large enterprises using version control and check-in/check-out functions. Modeler supports Smart Nodes and multiple instances of all nodes. It supports looping and an Expression Editor that allows runtime editing.

#### 3.1 Sub-Processes

IBM WebSphere Business Modeler supports subprocesses, which may be at various levels. There are specific objects that represent subprocess and the grouping of multiple activities. The overall processes provide a higher-level description of the models with the underlying details within the subprocesses. A high-level process can be decomposed to as many subprocess layers as necessary thus allowing users to group activities together in order to analyze and implement them as discrete components. Modeler supports chaining and both synchronous and asynchronous calls.

#### 3.2 Shared Data Space

This may be best seen in the demonstration, particularly looking at the task timings and calendaring function of the WB Modeler.
The WebSphere Business Modeler has one shared data space that can be used to view not only the graphical representation of the process but also the information contained in the Resource, Organization, and Information models that are associated with any given business process. Modeler supports arrays on all object types, including other WB Modeler objects such as groups, discussions, chat sessions, and others.

3.3 Forms

In the new release of WB Modeler, IBM has delivered the ability to attach forms and documents to the model itself, both during the modeling time as well as through a web-based collaboration environment.

3.4 Time

WebSphere Business Modeler can track the timing of the tasks at both the node and the process levels. It supports multi-level escalation. The task objects are correlated with the resources assigned to complete the activity. The resources can be assigned to specific work calendars. These work calendars
support flexible time schedules allowing an enterprise to model the resource constraints of an organization worldwide.

### 3.5 Process Optimization and Simulation

WebSphere Business Modeler includes an integrated, Discrete Event simulation environment and sophisticated optimization capabilities that enable you to analyze the operational efficiency of business process and potential business results, all before committing resources to development and deployment. The simulation capabilities of the WB Modeler allow for the ability to do powerful comparison analysis of processes to determine which processes provide the highest return on investment (ROI).

### 3.6 Process Collaboration

For developing best practices business models, IBM WebSphere Business Modeler Publishing Server Version V6.0.1 enhances WebSphere Business Modeler by providing a way to publish business processes and related business information, such as organization diagrams, to a secure Web site. It supports the development, documentation, and dissemination of business process models on an enterprise and worldwide scale, so that subject matter experts can provide their insights and comments. The Publishing Server provides the ability to publish business process models to a portlet-based server—enabling new employees to gain a high-level view of their role in the company and identify tasks they're expected to perform. It also allows review and development by multiple subject matter experts simultaneously through a standard Internet browser, and facilitates partial or entire publishing through WebSphere Business Modeler for business process modeling projects. This helps to ensure refinement of accurate and concise models.

### 4 Business Rules

WB Modeler and WebSphere Process Server both support business rules (with the majority of rules development taking place in WebSphere Integration Developer). IBM’s BPM Engine supports constraints and rules within its WebSphere MQ Workflow environment.

Instead of offering a major Business Rule engine with its BPM offering, IBM partners with the various rule engine vendors (e.g., ILOG, etc). In this way customers can choose the rule engine that best matches their requirements. IBM is supporting the development of two OMG business rule standards, one for describing rules in English (the Business Rules Semantics metamodel) and one for describing rules for systems that use inference engines (the Product Rules metamodel). By mapping to these open standard models, any rule vendor can assure that rules developed in its tool can be stored or moved between tools. Thus, IBM will let users decide which rule engine to use, and will simply assure that a company can shift from one engine to another, or combine rules developed in multiple engines in a common business rule repository. Predictably, several of the leading rule vendors will work hard to be perceived as the rule tool to use with IBM’s BPM offering.

### 5 Integration

IBM’s EAI/SOA capabilities are generally combined with its WebSphere Process Server offering. Considering that diverse types of databases, packaged applications, and platforms that companies need to combine when they seek to create integrated enterprise applications, IBM, as the preeminent enterprise systems integrator, provides a rich set of application and technology adapters. It is safe to assume that IBM’s BPM engine will be able to access and manage almost any kind of software component or data source—including human or workflow—needed in the execution of a process.

In terms of creating new applications the WB Modeling tools export to UML, FDL or BPEL to assist in the creation of applications -- for example, in Rational XDE.
In the case of interfacing to applications when the To Be model is to be run, WB Modeler version 6 exports a set of artifacts for WebSphere Process Server. These artifacts include the BPEL for the process definitions, XSD for all of the data definitions, and the WSDL for necessary Web Service Interfaces. The Process Server Service Interface is very capable in terms of the interfacing to applications, and in the services approach to integration. This allows the process engine to choreograph multiple applications. In addition, the server is a J2EE application server, allowing further creation of application code.

As you would expect, IBM provides excellent support for transferring information from its BPM environment to IT software development tools when it is necessary to modify the underlying software components or databases being managed by the BPM engine. For years, IBM has been a leading sponsor of the Object Management Group, and has contributed significantly to the OMG’s UML (software development notation and metamodel), and to MDA (the Model Drive Architecture), a generic methodology for moving from one type of model to another. MDA’s success depends on a set of metamodels that are all mapped to a common metamodel, making it possible to move information about the models and instances of the models from one tool to another. We have already mentioned that IBM’s WB Modeler was written in Eclipse, an open standards platform written in Java. In a similar way, IBM supports the OMG’s Business Process Semantics Metamodel, which makes it possible to shift from one process-modeling tool to another, or from a process model to a UML model for software development. Similarly, any product developed in compliance with these OMG metamodels, which IBM’s BPM environment will support, can shift information in XMI, an XML language supported by most process and software modeling tools, including IBM’s Rational Rose. Thus, whenever a company needs to create or modify an underlying software component to work with a business process, information can be easily moved from the IBM BPM environment to a software development environment, like the one provided by Rational Rose, with a minimum of difficulty.

6  Organizational Structure

IBM’s WebSphere Process Server has a built in directory system that can model employees and roles; the system is derived from its WebSphere MQ Workflow product. It also provides bridges to LDAP, which enhances easy message routing and the creation of business services.

7  Process Adaptability

All work items share a single process description, or products that offer ability to bypass, redo, or rollback steps, or products that support case handling environment (a library of sub-processes embedded within parent process) or that end-users can use to create their own processes fragments and apply them selectively.

IBM WebSphere Business Modeler and Process Server allow you to support a concept of error handling and fault handling. In your model, you can build different scenarios to handle exceptions that might occur without human intervention. A user can reassign tasks and edit the model underpinning a current process instance, as needed.

8  Process Lifecycle

The product has an administrative console that supports control and deployment of process models, supports version control, and the administrator has the ability to overwrite existing published processes. The product records reasons why changes were made.

IBM WebSphere Business Modeler supports Lifecycle Management through an administrative console that supports control and deployment of process models with version control. The product also allows you to compare multiple versions to determine impact of changes being implemented prior to updating.
or adding a new version ensuring proper visibility in the process design. The versioning capabilities for the Modeler are within the open standard CVS system.

9 Monitoring, Measurement and Management Information

Most of today’s BPM Suites either lack process monitoring capabilities, or do monitoring poorly. In essence, they present supervisors with data about what is happening as the process is executed. The data are usually only useful to process supervisors, not to senior managers, who need more context and data summarized in various ways. IBM sets out to remedy this deficiency on a grand scale. First, there is IBM’s WebSphere Business Monitor 6, which can provide supervisors with information about a process. IBM supplements this with additional monitoring functions and analytics.

IBM goes even further by integrating its Tivoli Business Systems Manager, which monitors the performance of software systems and resources and uses analytic techniques to analyze and relate the effectiveness of IT support to process performance. Using Tivoli, IBM makes it possible for IT managers to quickly determine if process problems are related to underlying problems with IT software, middleware, or database functions.

IBM monitors also manage metrics. In some cases, a company will specify Key Performance Indicators (KPIs), and IBM’s monitoring tools can monitor and report when KPIs are achieved. In other cases, IBM’s monitoring tools, using data mining techniques, will identify KPIs from the data and bring them to the attention of managers.

Using IBM’s WebSphere Information Integrator, companies can federate information from throughout the enterprise. Thus, IBM can gather data about sales in stores, items returned, complaints filed, and dollar goals achieved to date, to provide a broader context in which to understand a given product production process. IBM’s DB2 AlphaBlox technology enables companies to analyze and present their data in summarized form and support drill down capability.

Obviously, IBM is capable of providing more information than any one business manager could evaluate or use. Thus, IBM creates a foundation that can support different manager dashboards and reports. In essence, one imagines a team of business and IT managers, with each able to view different dashboards, while working together to change or improve a business process.

At the same time, IBM specifies APIs for its monitoring utilities so that companies can use other vendors’ analytic engines to analyze either business or IT data.

Monitoring a process, no matter whether you focus on the execution of activities during the course of the process, or on how efficiently activities are obtaining information from databases, depends on tracking events that occur during a process. Every time an employee presses “ENTER” to let the system know that a purchase order is complete, or whenever a software system initiates a message to a Credit Card agency that requires an evaluation of a cardholder, an event occurs. Every BPM product has some way of monitoring events. Unfortunately, different BPM products monitor and record events in different ways using different formats. IBM has defined a common set of event types, called Common Base Events (CBEs), with its partners and has submitted CBE as an open standard approach to OASIS. In time, OASIS will undoubtedly issue a Common Business Events (CBE) specification. At that point, any vendor that wants to interface with IBM’s BPM environment can do so by using the CBE standards, thus assuring that companies can mix and match a variety of BPM tools, depending on their needs.

Manager’s Interface. The various managers’ browsers that a given company might create can all be developed and presented via the IBM Workplace facility. This facility not only supports a clean browser interface, but also provides the tools necessary to represent data in any of a wide variety of ways, and provides a collaboration function.
The IBM Workplace screen is divided into a number of Portlets that can be used to display a variety of information based on various users’ roles. What is shown depends on the products being used in the specific company’s BPM suite. Assuming the company is using IBM’s WB Modeler, WB Monitor, and Process Server, the monitor will be capable of showing the process model being managed, and a variety of information about the events taking place in the process. If the company were using Corticon’s Rule Engine, a Portlet interface would let the user access information on the rules being used by specific activities, and so forth. The key is that IBM has created a standard interface and a server to send the interface to users. As IBM or a partner’s products are added to the BPM environment, developers can add different panels to make more information available to the various user screens being used in the application.

10 Templates and Frameworks

IBM licenses a series of vertical industry templates that populate the WB Modeling tools. One example of this is the Information FrameWork, which delivers a large number of template processes for Retail Banking. Descriptions of this may be found at

http://www.ibm.com/industries/financialservices/doc/content/component/software/397443103.html

There are other equivalent models available from IBM in other industries.

IBM is also offering a number of frameworks or templates that can be used to assist companies in the development of specific types of business processes. To cite only two examples: IBM has worked with the insurance industry consortium, ACCORD, to create an IBM ACCORD Package that provides insurance industry specific process knowledge for insurance companies that use IBM’s BPM offering. Similarly, IBM supports the international, de facto ITIL standard, which companies can use to define and rapidly develop IT service processes.

11 Vendor

IBM is the largest computer technology vendor in the world with some 330,000 employees, and a wide range of hardware, software, and consulting service offerings. Its revenue in 2005 was US $91.1 billion. Its corporate headquarters is in New York and it has research, manufacturing, and support offices throughout the world.

Other BPM vendors must worry about their ability to support the wide variety of different BPM initiatives. IBM provides a comprehensive package of BPM offerings including software, services and education. IBM’s capitalization and its active participation in all leading standards initiatives assures that IBM’s offerings will be among the leading BPM products in any foreseeable future.

12 Cost

The licensing structure is such that the modeling and tools products are licensed to users. IBM offers a discounting structure to IBM software users, based on volume. Server products are generally based on a per CPU pricing and WebSphere Adapters are per instance or per establishment.

The IBM WebSphere Business Modeler Basic Edition is US $1,250 (in USA).

The IBM WebSphere Process Server starts at US $85,000 (1 CPU) for distributed versions.

IBM WebSphere Integration Developer authorized user license entitlement is US $3,500.

IBM WebSphere Partner Gateway is US $35,000. IBM WebSphere Adapters are US $16,000 and $24,000 for technology and application adapters respectively. For a very broad indication, a two-processor system, which may support the 32 users above, is around US $110,000 at list, and therefore lower for an existing IBM user.
Business Convergence Suite

Version: 2.2
UPDATED

M1 Global Solutions, Inc.
5775 Glenridge Drive NE, Building E, Suite 400, Atlanta, GA 30326
Tel: 770-250-0349
Web: www.m1global.com Email: cgary@m1global.com

1 Product Overview

M1 Global’s Business Convergence Suite uniquely leverages network convergence (voice and data) and Service Oriented Architecture (SOA) to enable a user to create communication-enabled business processes. It accomplishes this by combining the power of the process model and execution engine with embedded interaction management technologies. The resulting Convergence Engine orchestrates communication channels (e.g., voice, web, email, etc.), manages people-based workflow including complex skills-based routing of tasks, and integrates to Web services and other data sources. M1 Global also makes their technology available in an On Demand model, which includes all of the corresponding technology infrastructure components.

By creating communication-enabled business processes, a company can create powerful model-driven applications that not only interact with customers and partners at a data level using screens and Web services, but also insert collaborative communications and self-service capabilities throughout the process.

M1 Global points to the need to link customer channels with business processes. In many traditional development environments, the interface is independent of the module in which one describes the business process. Yet, when it comes to the human-centric tasks, the interface mechanisms are usually as important as the business process itself. One cannot always assume that the customer is going to take part in the process only via the Web. He or she may walk into a retail branch, make a phone call, send a fax, or send an email. The ideal way to handle these different channels is to create a common process for the different business functions (e.g., account open, address change, etc.) and then create channel-specific interfaces that are all tied to the common process. The benefits of such an approach include reuse of business process logic such as integration to data sources, integration of customer interaction channels, and common customer experience across channels.

Utilizing a BPMN compliant process-modeling environment (M1’s Convergence Studio), business users build high-level process models for the core process. M1’s Convergence Studio is then also used to build the various interfaces (e.g., Web application flows, voice application flows), and complete process models with technical details, such as Web Services configuration and data mapping. In addition, enabling user interfaces with collaboration capabilities such as click-to-talk and Web-collaboration (e.g., screen sharing, white-boarding, form filling, etc.) is accomplished with a few clicks in the process and interface models. M1 Convergence Studio is available for download under a free license.

As business process models are completed, they may be deployed with a single click to M1’s Convergence Engine. The Convergence Engine is a highly-scaleable process and interface execution server that coordinates and manages the process flow, along with all integration needs (via Web Services and/or JDBC database access) with the various channels of interaction (including integration to the PBX, IVR, Web servers, email servers, chat, etc.). Rather than handling each channel as an external application that must be integrated via data, Interaction Managers enable the firm to use the Convergence Engine to directly execute subflows that are specific to each channel.
While other BPM Suites often provide support for the web-based screens, the M1 Convergence Suite directly supports all potential interaction channels involved. For instance, the Convergence Engine can be used to execute self-service voice applications or transfer phone calls and data to the correct user. Moreover, the environment incorporates an enterprise-class, skills-based routing component that can make sub-second routing determinations that use complex skills matching algorithms typically found in large call center applications. However, instead of using skills-based routing in an Automatic Call Distribution (ACD) fashion, the Convergence Engine instead routes Work Items to anyone, whether they be contact center reps, back-office personnel, relationship owners, or outsourced partner resources. Work Items may have media attached, such as a phone call, or may be traditional data-based tasks to complete.

While M1 Global does offer its software under a traditional subscription contract, M1 Global’s focus is on providing the rich multi-channel capabilities via an On Demand infrastructure called the Business Convergence Platform. By allowing users to create communication-enabled business processes that can then be pushed up the platform, customers are able to better support business process outsourcing and distribution of work to remote locations, while avoiding the capital costs of traditional onsite deployments. The Business Convergence Platform includes the hardware and software infrastructure components such as PBX, VoIP equipment, IVR, Web servers, email servers, and chat/collaboration servers. The infrastructure is deployed in a state-of-the-art hosting facility with carrier-grade bandwidth for data and voice traffic (both VoIP and traditional circuit-switched TDM).

Because the Business Convergence Platform includes these components, it is best targeted at multi-channel business processes that involve the coordination of multiple communication channels, systems and people inside and outside the organization, such as a mortgage loan application process. In addition, the On Demand nature of the platform enables an organization to test the benefits of SOA, BPM, and even VoIP and Voice Self-Service without large capital expenditures.

2 BPM Engine

The M1 Convergence Engine is the runtime component of the M1 Convergence Suite. The Engine manages the state of all process instances and participants, handling the process flow and integrating external systems with channel-specific communications hardware/software. Its underlying architecture is designed to ensure that both human and system based resources are prioritized appropriately; to support both synchronous and asynchronous communications routing; and to deliver work within both long- and short-running business processes.

The Engine has integrated modules called Interaction Managers that are responsible for managing different interaction channels when engaging participants outside of the main employee-focused Work Portal. These components execute the channel-specific integration logic to talk to enterprise communications hardware/software (PBX, IVR, web server, email server, Web Services, etc.). Interaction Managers direct the interaction channel according to the business process and underlying channel-specific interface flows modeled in M1 Convergence Studio. Where possible, these Interaction Managers leverage related standards, allowing the product to talk to the widest range of systems. For instance, the Interaction Manager for voice uses VoiceXML to drive a natural language speech application and CSTA to manage phone calls on a PBX.
The product incorporates a sophisticated Skills-Based Routing component. Instead of limiting work distribution to role-based routing, this component applies the sophisticated algorithms used in massive contact centers to make sub-second routing determinations for all types of work. To do this, the Routing engine matches work items (including synchronous and asynchronous media types) to users, based on a number of factors such as skills, availability, utilization, proficiency, desire to use, desired work item cost, etc.

The State Management component handles a number of different things. In common with all other BPM Suites, the engine maintains the state of all process instances (cases). But it also tracks the live status of individual users and other components in the system, allowing the system to differentiate between employees when trying to support both synchronous interactions (Chat/IM and other synchronous collaboration environments). Cold work includes email or approval tasks, whereas phone calls and chat sessions need people that are there (not in the bathroom or out to lunch). This status information is also linked into the workload distribution algorithms and skills-based routing components.

At deployment time, individual process models are converted to byte code. While an interpreted model has certain advantages, it cannot handle the sub-second response times required by a telephony network (typically less than 200 milliseconds).

The entire suite makes extensive use of Web Services. They are used for all external LOB application integration, and they can be used to facilitate the reuse of processes as objects, and/or to fast track the development of a Shared Data Space. The Web Service Interaction Manager enables third party applications to invoke processes within the suite and, unusually, query and report on the status of process instances. We understand that the next version will provide full Web Services access to all administration functions, such as the retrieval of all work items assigned to a user/team, or the listing of all instances of a given process (e.g., all open loan applications), and other system administrative functions.

### 2.1 Platforms

M1 Convergence Engine requires a J2EE application server running on either Linux or Windows. It is currently certified to run on IBM WebSphere and JBoss. The database must be either Oracle or DB2. M1 Convergence Studio is a plug-in to the Eclipse IDE framework.
2.2 User Interface

The Work Portal leverages a portal framework to allow an organization to easily bring together all the components users need to perform their tasks. M1 Global delivers two components out-of-the-box – a Work Item Control portlet and a Business Process portlet. Together, they allow a user to manage and work on Tasks that have been assigned to them. When a user opens a particular work item, the Work Portal may also pop additional portlets and/or third-party applications to support that task according to how the task has been modeled in M1 Convergence Studio.

2.3 Scalability

The M1 Convergence Engine is a J2EE-based platform that takes advantage of the inherent scalability and fail-over capabilities provided by leading J2EE application servers. Each primary component of the Convergence Engine may be run on separate physical servers. In addition the business process servers may be replicated across multiple physical servers to scale out.

The work distribution algorithms support load balancing of resources, ensuring that particular users or work queues are not overloaded.

3 Processing Modeling

M1 Convergence Studio is an Eclipse plug-in and uses the BPMN notation standard as a foundation for process modeling. Models are stored in UML (not XML). All process logic – including Web Services configuration, data mapping, and skills-based routing properties – are configured in the process model. Additional interface specific palettes are provided for modeling the more complex interface flows (such as Web forms, voice tasks, etc.) needed to implement a given user task in a process model.

From a notation perspective, M1 Global has extended BPMN around routing and interface subprocesses as well as coloring the icons. Where different channel interfaces are needed for a Task, the Engine is effectively calling an embedded subprocess that executes the channel-specific interface. Each Task shape carries a small icon depicting the specific channel. From a Routing perspective, the environment provides for Direct Assignment and Route attributes on Tasks. The Direct Assignment feature allows the modeler to specify a specific user, role, or team (bypassing the skills-based routing associated with Queues).

Although it is usually desirable to separate the channel specific logic into subprocesses, it is not always appropriate given the scenario. For instance, the Authenticate Customer task in the mortgage process shown in Figure 2 checks to see whether the customer interaction is coming in over a voice channel, in which case it routes the authentication activity to a Contact Center Queue where it is handled by a human operative.

3.1 Subprocesses

The M1 Convergence Suite supports both embedded and independent subprocesses:

- *Embedded subprocesses* are contained within the parent process. They share the same Business Data Document (BDDs) as the parent process. Consequently, there is no need to map data in/out. (For more on the BDD, see below.)

- *Independent subprocesses* are stand-alone business processes that run as children of the parent process. Independent subprocesses may contain their own BDDs and therefore may have data mapped in and out. Data mapping is managed using a graphical drag-and-drop interface.
Further, the semantics of the product include a *Launch* Task that spawns a new process fragment linked to the case. The parent does not wait for the newly-launched process to complete; instead, it carries on without waiting. There is also a Terminate event which ends all threads of the process. If the Terminate event is part of a subprocess, the parent process is terminated if the subprocess is embedded. If the subprocess is Independent, then the parent process is not terminated.

3.2 Shared Data Space

An explicit SDS is provided in the form of a *Business Data Document* (BDD) that maintains all of the data pertaining to a business instance. The structure of the BDD itself is an XML schema representation of the data referred to by the business process. At runtime, data that comes into the system, whether from a user task or a data access task (such as a Web Service), is stored in a BDD for the case.

BDD formats may be imported using XML Schema (XSD), which facilitates the use of enterprise document standards (such as OAG, IFX, ACCORD, SWIFT, etc.). Alternatively, one could import the data structure associated with a Web Service via an introspection of its WSDL. In addition, the M1 Convergence Studio includes a graphical XSD editor that may be used to create and/or modify *Business Data Documents* directly within the tool.

A mapping mechanism is provided to support the construction of the BDD and the passing of contextual information to subprocesses or third party applications. Arrays are supported.

3.3 Forms

Using a built-in wizard, Studio users can create JSF Web interface forms by selecting the appropriate data elements contained in the *Business Data Documents* that are associated to the process. Web Interface flows can be as simple as a single web screen, or may include multiple screens with gateways, script tasks.
and data access steps, if required for a complex interaction. Graphical layout of the Web screens is easily accomplished with integrated third-party Eclipse plug-ins.

![Figure 5. Mapping the data structure of a Web Service into the BDD](image)

### 3.4 Time

Under the semantics of BPMN, the Timer Event allows the modeler to specify a wait period or time constraint on a business process. This is modeled as either an Intermediate Inline Timer event (between Tasks) or a Boundary Timer event (where a Task or Subprocess must be completed within a specified period of time).

### 3.5 Process Optimization and Simulation

No specific simulation tool is provided within the Suite. At design time and runtime, M1 Global captures task-level metrics, which can be exported for activity analysis and simulation. A basic simulation tool will be included in the 3.0 release.

### 4 Business Rules

Business rules may be reflected directly in a process model – such as logic in a gateway – or externalized by using a variable in a process. The admin tool is then used to update the variable as business rules require.

### 5 Integration and Integration Engines

The primary method for integrating third-party applications is through the use of Web Services. Web Services Tasks can send and receive data, or enable the orchestration of third-party component services. Further, the Interaction Manager for Web Services enables a third-party application to invoke a business process. When Web Services are not available, there is also a set of database task types that can be used to integrate to a JDBC-compliant database.

Additionally, the environment supports desktop-level integration by allowing a process modeler to specify when the Work Portal should pop a screen or portlet from a third-party application to support a given process task.
6 Organizational Structure

The admin tool provides a role-based security framework for managing and configuring the system. User-related administrative tasks include the configuration of users, user skills, teams, queues, and portal definitions. Security is also enforced in the portal to prevent unauthorized access to process tasks. These permissions are configurable by role, team, and user, and work item type.

As mentioned earlier, the Suite incorporates a sophisticated skills-based routing component, providing capabilities to distribute work beyond that which is typically used in a BPM engine. When routing work to queues, the Suite extends direct queue assignments by applying skills matching algorithms. This allows the product to locate the correct user, based on their skills, their availability, cost factors, desire to use, the work they already have lined up, the time required to carry out the work, their experience level, etc. This facility is also used to load-balance the human resources in the business, ensuring that one worker is not overloaded. All of these factors can be configured in the process model.

Typically, this sort of functionality is found in a large contact center where work is distributed across the workers in real time. M1 provides the capability to apply that same level of sophistication to the way work is distributed to all employees in the business. To accomplish this, in addition to having knowledge of users and their skills, the Suite also maintains user availability when deciding whether to route an item that requires immediate attention, such as a phone call.

7 Process Adaptability

Given the appropriate permissions, a user may adapt the process to better handle a task such as reassigning a work item to another user to complete. Secondly, subprocesses can be called dynamically, based on variables within the BDD. Effectively, this enables the process developer to design situations where either the user or a programmatic script could decide which subprocesses should be called, based on the circumstances of the case.

8 Process Lifecycle

The Suite includes a tool to deploy the process and interaction models to the Engine and the appropriate Interaction Managers while managing process versions. This supports the developer in modeling before deploying to a test environment prior to production deployment. The deployment tool also includes the ability to manage details such as specifying the process components that should be on external web servers (for customer interactions) versus internal web servers (for Work Portal users).

9 Monitoring, Measurement, and Management Information

Along with the BDD (which holds variable information about the case), the Suite maintains a Business Process Document and an Interaction Document. The Business Process Document is a system-generated document that maintains all information about an instance, including things like status, current tasks, linked interactions, and a history log. The Interaction Document is a system generated document that maintains all information about an interaction – which is defined as a single interchange between the Engine and an external user (i.e., someone not using Work Portal), such as a phone call, a web session, or an email.

By maintaining separate Business Process Documents and Interaction Documents, the system allows for multiple interactions in a process instance, and for interactions that span multiple processes (many-to-many relationship between process and interaction). Both document types are standard XML and may be referenced in a process model if required.

Given the current maturity of the product, out-of-the-box functionality to leverage this information is relatively limited (the Crystal Reports suite is used to provide management reports). However, it should
be noted that this approach provides a much richer set of audit information than is normally available in BPM products.

The set of Interaction Documents is, in effect, the contextual information related to the business case and could contain recordings of phone conversations, email interactions, or even Chat sessions. Moreover, it provides the supporting information for assessing SLAs at a team or individual level. Alternatively, one could use these data to support a comprehensive customer relationship management view, capturing the context of all processes and interactions that relate to a given customer.

In addition to logging robust data about both processes and the associated interactions, the admin tool includes a real-time view of all running processes.

10 Templates and Frameworks

M1 Global offers a range of process and interaction models for a multi-channel contact center. In addition, M1 Global, as a member of the OAG, supports OAG standard supply-chain BDDs and the associated messages.

11 Vendor

M1 Global was founded in 2003 by Michael C. McChesney, who previously had founded, among other companies, S1 Corporation and Security First Network Bank (SFNB) – the first Internet bank. S1 Corporation is a leading provider of software for financial institutions providing banking on the Internet. It employs more than 1,600 people. Michael also founded WebTone Technologies, which specialized in multi-media interaction management, including voice, email, and web contacts. In total, M1 currently has over 50 employees across its two locations, the headquarters in Atlanta, Georgia and an offshore development center in St. Petersburg, Russia.

12 Cost

M1 Global provides its software on both a software leasing model and an On Demand basis. The software leasing option is designed to allow customers to reduce the capital outlay required to allow a manageable monthly charge. The outlay for a 3-year lease is roughly equivalent to the cost of equivalent server software but has been rationalized into a monthly lease cost (typically, thousands per month). The modeling environment, M1 Convergence Studio, may be used for free and is available for download.

The On Demand hosting service is transaction oriented, mixing both resource consumption and a shared value agreement. This allows customers to focus on what they do best, while M1 develops the software and processes for them, using both US based and offshore resources.

Non-Hosted Scenario: For a 100-user web-only system, the charge would be $3,750/month for a lease. Additional channels, such as voice, would add to this. For example, a 100-person multi-channel contact center would be $5,350/month.

Hosted Scenario: For a 100-user web-only system, the charge would be $8,500/month under a 3-year contract. Additional channels, such as voice, would add to this. For example, a 100-person multi-channel contact center would be $25,000/month. Note that this includes the contact center infrastructure such as PBX, IVR, etc.
1 Product Overview

The Oracle BPEL Process Manager provides a comprehensive BPEL-based integration platform to orchestrate interactions between systems, services, people and partners in an end-to-end process flow. A key design aim of the product was to deliver a 100% standard BPEL process engine that would enable more effective SOA-based solutions, yet would enable people to take part in the process. Overall, it provides a developer-friendly and reliable solution for designing, deploying and managing business processes. BPEL Process Manager also leverages the bundled Oracle Business Rules component where Oracle Application Server 10g is used (other Business Rules engines and Applications Servers are supported).

Oracle’s long-term product strategy in this area is to enable Service Oriented Architectures with a standards-based middleware suite that operates well in heterogeneous environments. Oracle BPEL Process Manager is the cornerstone of this enterprise-wide vision. It allows painless customization of major enterprise-oriented applications, supporting effortless future upgrades, while also facilitating new process-oriented application development. The various suites of applications that Oracle has purchased (PeopleSoft, JD Edwards, etc.) are currently being re-architected and rebuilt to leverage the capabilities of this middleware suite, with the aim of ensuring greater agility. The problem for major enterprises using enterprise-oriented packages today is that they are monolithic (i.e. the entire product is necessary) and that customer-specific customizations make it extremely difficult and expensive to keep the underlying application up to date (with new releases etc). The Oracle approach will enable the firms to be more agile, by picking and choosing the components that they want to use, and overlaying their customer specific changes through a set of business process extensions.

Oracle BPEL Process Manager enables custom and packaged business applications to be extended, customized, and enhanced by exposing their components as services and events, allowing them to participate in flexible interactions. Moreover, this value proposition should appeal to ISVs looking to make their applications more adaptable.
Oracle has provided additional functionality—a set of services that enable the support of human interaction and manual tasks. Rather than extending the underlying BPEL language itself (with embedded proprietary Java), Oracle has chosen to layer this set of discrete services on top of BPEL. To achieve the desired functionality, the BPEL process description invokes the services (through Web Services or directly inside the engine via Java—see Figure ). At the level of the process definition, this is transparent but still allows Oracle BPEL Process Manager to provide a rich set of capabilities to manage, update and secure these services, ensuring they work within the right context.

Moreover, if a firm has already developed equivalent services, or has them available within another application (for example a Business Rules component or a Worklist handler), then, using Oracle BPEL, they can be used instead of the out-of-the-box Oracle services delivered. Indeed, some customers are wrapping existing functionality with Web Services in order to leverage the functionality delivered by Oracle BPEL Process Manager.

Apart from the underlying Oracle BPEL Process Manager, the product also includes the graphical Oracle BPEL Designer (both Eclipse and Oracle JDeveloper versions are available), and a BPEL Console for management, administration and debugging of processes deployed to the BPEL server. It also includes a bundled Business Rules engine (that implements the “Decision” service). Audit trails and process history/reporting information are automatically maintained and made available both through the BPEL Console and via a Java API.

2 BPM Engine

The core Oracle BPEL Process Manager is a scalable and robust BPEL process engine (Figure ). It executes standard BPEL processes and provides a “dehydration” capability to store state information in long-running processes in a database, enabling clustering for both fail-over and better scalability. The BPEL Server itself leverages the functionality of modern J2EE application servers, with support for most major commercial application servers (i.e. not limited to Oracle). The server itself also contains a WSIF-based binding framework for integration of external services along with a number of built in facilities to support interaction with third party applications and user tasks.

![Figure 2 - The core Oracle BPEL Process Manager](image-url)
intermediary format. It supports context dehydration and persistent storage through an associated database (most major products supported), as well as support for large XML documents.

The product features built-in integration services through JCA adapters (for packaged applications and legacy systems), JMS, FTP, Email services and Java embedding. It also incorporates direct services support for XSLT and XQuery transformation (along with support for non-XML to XML translation). The product also incorporates a sensor-based API to capture process execution events, which opens up event-based data to BAM products for real-time process analytics.

Through configuration options in the BPEL Console, Oracle BPEL Process Manager provides “Domains” to partition the business problem. Domains are used to provide logical partitioning, to optimize performance, reliability, security or set controls over other quality of service aspects. Each Domain, with its own set of configuration options can deliver a different layer of processes that are managed independently of each other. This approach allows the firm to support different levels of service for different classes of customers from the same logical BPEL engine. This is particularly useful for hosted environments and for ensuring that development, production, and testing environments are maintained separately.

Layered on top of the core BPEL Engine are the six “Workflow Services” that extend the capabilities of BPEL to enable the integration of people and manual tasks into BPEL process flows.

As shown in Figure 4, Workflow Services are linked to a BPEL process through a WSDL contract, like any other Web Service. The process assigns a task to a user or role and waits for a response. The users act on the task using Oracle BPEL Worklist Application.

Oracle BPEL Process Manager is designed from the ground up as a comprehensive, standards-based solution for creating, deploying and managing cross-application, end-to-end business processes leveraging a service-oriented foundation. The BPEL process engine natively orchestrates interactions between Web Services and, is itself, a Web Service with a well defined WSDL.

The next major version of Oracle BPEL Process Manager (version 11) will include customizable process patterns, self documenting processes, data driven customization, etc. These features will focus rich
extensibility support for applications through processes, while delivering a consistent fusion-oriented interaction framework for all human interactions with these applications.

2.1 Platforms

Oracle BPEL Process Manager is supported on the following Operating Systems: Windows 2000 and XP, Sun Solaris 2.8 and 2.9, HPUX 11, and Linux 2.1 and 3.0. IBM AIX support is planned. From a database point of view it supports Oracle 9i and above; Microsoft SQL Server 7 (and above) and Sybase, with DB2 due for imminent release. Application Servers supported are: BEA WebLogic 6.1 and above; IBM WebSphere; JBoss and Oracle. Directory Server approaches supported are Oracle Internet Directory (OID), LDAP and Active Directory.

2.2 User Interface

The BPEL specification does not provide a standard way to include user tasks in BPEL processes. To solve this problem Oracle BPEL Process Manager provides the Task Manager Service. Task Manager is a built-in BPEL service (similar to E-mail and JMS service), which enables the inclusion of user tasks in BPEL processes. Task Manager is an asynchronous service and provides two interfaces:

- The first is a WSDL interface used by the BPEL process. A BPEL process simply invokes the Task Manager. Through the invocation it expresses the need for the user interaction. It can also update or complete an existing user task. The Task Manager performs a callback to the BPEL process after the user interaction has been completed or if the task times out.

- The second interface of the Task Manager is the client API. Using this API, developers can build custom user interfaces to carry out user interaction. Developers can also list and look up tasks. The client API is available as a Java API (called Worklist API) and is used to develop user interfaces in Java (JSPs, for example). The client API is also available as a WSDL interface. This enables custom user interfaces to be implemented in Microsoft .NET, Adobe Forms, or any other client technology that supports Web Services. The client WSDL interface is not available by default and has to be deployed through Worklist Manager service, which is actually a wrapper for the Java Worklist API (see Figure ).

The out-of-the-box Worklist application is fully customizable, using role resolution to determine which tasks a user can view. Users can filter tasks in the Worklist based on various criteria and acquire (checkout) shared tasks.

![Worklist application](image)

Figure 5 - The out-of-the-box Worklist application

Users can also be notified of tasks to undertake and specified task changes via different delivery channels (email, phone, fax and SMS). Further, users can also perform actions on certain tasks via email, SMS, and IVR systems by using support for VoiceXML (Voice Markup Language).

2.3 Scalability

Each BPEL PM server leverages the J2EE app-server for transaction execution, pooling of threads and database connections, guaranteed delivery of messages, etc. Process steps are executed in a stateless fashion, with all state information stored in the database (called the “dehydration store”), utilizing a high performance binary DOM format for efficient storage and retrieval of process state. All of this is
wrapped in a JTA transaction so that if a server fails during a given step, no information is lost. A “Recovery Service” component will pick up that instance, executing it where it left off on a different server (where possible).

This whole environment is optimized to execute over a hundred process steps per CPU per second (average using modern commodity hardware). On the other hand, a large number of configuration settings are provided to gain optimal performance under specialized conditions. For example, synchronous processes can be executed “end-to-end” with the dehydration turned off, so that the entire process executes in memory. This is a common scenario and is used by several customers with high performance requirements, some of whom have achieved as many as two hundred transactions per second. Finally, as a result of the stateless architecture of the core BPEL engine, it is possible to achieve near linear increases in throughput through the addition of more engines.

3 Processing Modeling

The Oracle BPEL Designer (JDeveloper and Eclipse versions included) provides a drag-and-drop graphical modeling tool that developers can use to create native BPEL-based processes. As a result, processes are 100% portable while enabling developers to view and modify the BPEL source.

Wizards are used extensively to generate and configure common process flows (based on a series of workflow patterns). Out-of-the-box patterns include simple approval, sequential approval, parallel approval, ad hoc workflow, etc. Variations such as automatic task delegation, escalation, renewal, re-approval and reminders are also provided. These out-of-the-box patterns are combined by the developer to create more complex patterns. The underlying BPEL is automatically generated based on the graphical model.

Manual tasks are assigned to either defined users or by Role. Effectively, this functionality is based on the Identity Service that plugs into LDAP Directory Server (or Active Directory), which exposes a set of operations such as get user, get manager, get hierarchy plus 1, etc. At run-time the engine resolves the correct user for the process instance.

The modeling environment includes a UDDI and WSIL service browser along with a visual XPath editor. XPath editor can also be used for translation of data inside the process.
A number of third party modeling tool vendors have provided specific, additional functionality to integrate directly with Oracle BPEL Process Manager. These vendors use BPMN to generate BPEL and include the ProVision from Proforma, System Architect from Telelogic (Popkin Software), and Process Modeler for Microsoft Visio from ITP-Commerce. Other products that provide BPMN to BPEL generation could also be used to front end process development (e.g. IDS-Scheer, ProActivity and Casewise).

BPEL itself does not support sub-processes. Instead, sub-processes are standalone processes that are invoked at runtime as services. Where the service is long-running, Oracle BPEL Process Manager dehydrates the state information to the database and awaits a response. At runtime, sub-processes can be browsed using the built in WSIL (Web Service Inspection Language) explorer via the BPEL Console.

Through direct support for BPEL, it is possible to support looping behavior using “While” constructs, invoking a sub-process (service) while a particular condition is true. Through XPath support, it is possible to fire off a sub-process for each member of an array in the set of variables associated with the process instance.

In one sense, the “In-Line Scopes” aspect of BPEL provides another mechanism of constraining part of the process definition, limiting the scope of related variables (effectively an encapsulated child process).
3.2 Shared Data Space

Oracle BPEL Process Manager imports existing XSD files to create global process variables. It is also possible to create variables one by one for simple variable types (string, date, etc), or via an element, which then calls a browser to locate an appropriate XSD. Oracle BPEL Process Designer also features native XSLT support with automatic mapping (based on structural/name equivalence and through predefined dictionaries (see Figure ).

![Figure 9 - The integrated transformation tool allows developers to graphically map from one data-source to the structure of the Shared Data Space](image)

In some cases BPEL processes will invoke Web Services that return strings that are not XML. Using such Web Services with BPEL is problematic, as no BPEL function exists to parse string content to XML. Oracle provides a custom function that takes a string as a parameter and returns structured XML data.

3.3 Forms

JSP/HTML based forms are automatically generated for manual tasks and are customizable before deployment. In addition, users may use third party tools such as Adobe and MS InfoPath.

![Figure 10 - JSP based Forms are used for viewing and updating task details](image)

Customers may also build their own rich forms and user interface environments using standards-based technologies such as Java Server Faces (JSF).
3.4 Time

The BPEL process description has “Alarm” handlers to capture elapsed time. Developers may specify task escalation or renewal in case an expired task needs re-routing to another person. The ‘onAlarm’ functionality is used if the user selects an expiry time in the workflow wizard for a task. The expression options allow for the use of the variable data to set the value for time allowed for the task (or to calculate a fixed end-point).

![Image of onAlarm functionality](image)

Figure 11 – The onAlarm functionality is used to govern the time allocated to tasks

3.5 Process Optimization and Simulation

Oracle BPEL Process Manager includes development facilities to test the validity and robustness of the process model itself (using JUnit). Simulation at the level of the system performance (loading on the engine, application server and database) is also included. Otherwise, Oracle partners with third-party simulation tool vendors such as Popkin, IDS-Scheer, Proforma and ProActivity for business process optimization. We understand that Oracle has further functionality in this area under development, which will soon be available as an integrated business process optimization facility.

4 Business Rules

Isolating, exposing, and publishing business rule sets as services that are accessible by any application or process is a key concept required to support the Oracle SOA vision of unbundled enterprise applications.

Oracle BPEL Process Manager uses two different levels of business rules. At the simplest level, an XPath Expression Builder is used to build relative constraints at a decision points by defining the condition that must evaluate to true for the process to follow a given path in the process. The Expression Builder automatically leverages the existing structure of the SDS (the variables of the process) and incorporates a broad range of mathematical functions. The entire expression body is automatically generated by the Builder.

For more sophisticated business rules the process invokes a “Decision” service. This passes the relevant data to either Oracle Business Rules (complete with inference engine), or a third party business rules product. The Oracle Business Rules has its own the Rule Authoring HTML GUI and Java APIs allowing individual rules and related actions can be captured by the business user or analyst, independently of the process, while leveraging the same meta-data (SDS). Further external interface components for the Oracle Business Rules engine include: the Oracle Rules Language (RL) and the Rules UI SDK.
Figure 12 - The integrated XPath Expression Builder is used to define the rules related to whether a particular path in the process is followed.

Oracle BPEL Process Manager can also integrate with third-party Rules Engines (for example, ILOG) through the same Decision Service interface used for its native Rules engine, if they provide a Java (JSR 94) or Web Services API interface.

5 Integration

The built-in integration services enable developers to easily leverage existing IT investments from standard BPEL processes. These capabilities include support for:

- Data Transformation—XSLT and XQuery, as well as the BPEL Assign command, provide variable management and transformation capability.
- Connectivity—an extensible WS DL binding framework using WSIF enables connectivity to protocols and message formats other than SOAP. Bindings are available for JMS, email, JCA, HTTP GET and POST, and many other protocols enabling simple connectivity to hundreds of back-end systems.
- Notification—Email and messaging via FTP, HTTPS / SMTP messages.
- Messaging—the product supports JMS connectivity to a number of providers including Oracle, IBM, TIBCO, and Sonic. There is also native support for Oracle AQ and IBM MQ Series.
- Adapters—Oracle's Integration suite supports all JCA 1.5 adapters. Oracle supplied adapters fall into two major categories:
  - Technology: Oracle developed and supported adapters.
  - Applications & Legacy: OEM agreements with iWay and Attunity provide adapters for leading packaged applications and mainframe systems. Oracle provides support for these adapters directly.

Adapters are integrated seamlessly into the product. The connectivity type (SOAP versus an adapter, such as JMS or SAP, etc.) for any BPEL partner link is a deployment option, so changes in transport can be made without altering process designs.
Oracle BPEL Process Manager also provides native integration with Java resources in two ways:

- Java embedding enabling developers to embed Java code within a BPEL process.
- Web Services Invocation Framework (WSIF) with Java binding.

Further tight integration is available to other Oracle products including:

- Oracle Customer Data Hub for master customer data management.
- Oracle Integration B2B providing support for a wide range of protocols including RosettaNet, ebXML and EDI, as well as comprehensive trading partner management.

6 Organizational Structure

Organizational hierarchies are modeled using either Oracle Internet Directory or any third party Directory Server (LDAP or Active Directory). The Directory Server stores all organizational hierarchy (reporting structure) and group information. Tasks are assigned directly to users or roles (via the groups of the Directory Server).

Oracle Identity Management serves as the point of integration between the Oracle environment and any third-party Identity Management environments such as Microsoft Active Directory, Novel LDAP and Sun One Directory Server. Where customers make use of the Oracle Application Server, the product provides an integrated security framework supporting all components, as well as third party and custom applications deployed on Oracle Application Server. The framework is based on Oracle Application Server 10g Single Sign-On for authentication, the standard Java Authentication and Authorization Service (JAAS) for security services in J2EE, and Oracle Internet Directory for authorization and user provisioning.

In addition to users and role-based assignment of tasks, it is important to manage security policies for accessing services and applications in a distributed SOA environment. This is handled by the Web Services management component of Oracle Application Server. This component works seamlessly in conjunction with the Oracle BPEL Process Manager. Since Oracle is using standard Web Services, this functionality is also possible using other Web Service management tools (although Oracle provides this out-of-the-box).

7 Process Adaptability

For runtime adaptability of processes, Oracle BPEL Process Manager is relatively limited. Through the BPEL Console, managers have the ability to suspend and resume process instances. There is no current support for changing a given instance of the process. However, through the use of dynamically invoked sub-processes, it is possible to develop process architectures that is adaptable at runtime with sub-processes either being selected by users or invoked programmatically. Of course the process itself can be re-developed and redeployed but that will not affect the process instance in hand.

We understand that Oracle intends to support the modification of process instances on the fly in a later release, along with functionality to assess the impact of changes to BPEL process – both in drill down mode to invoked sub-processes and also upwards to the processes that call the process being modified.

8 Process Lifecycle

Design and deployment are decoupled. During the design and development phase, any version control system, including CVS, Perforce, and Clear-Case, can be used. Both JDeveloper and Eclipse provide integrations to popular version control systems for greater productivity. The BPEL engine supports multiple active versions of deployed process definitions. The deployment audit log records each
deployed process definition, including the deployer, timestamp, version information, etc. This log is viewable through the BPEL Console. Each deployed process indicates which services, including those implemented by processes, it uses.

9 Monitoring, Measurement, and Management Information

The BPEL Console contains various dashboards, which enables users to monitor processes, process instances and the activities/faults. The following types of monitoring dashboards are supported:

- **System Health dashboard**—displays the overall health of the system including the information about processes, performance of the processes etc.
- **Process dashboard**—displays the overall state of deployed processes, SLA Performance, instance details, throughput, pending activities and type details of a process type.
- **Process instance dashboard**—displays instance details, any faults, activities, audit trail, and the process instance flow graph.
- **Fault instance dashboard**—displays the details about a particular fault or execution errors.

These dashboards contain information about processes that are being executed as well as processes that have completed. All execution state information is maintained in storage until purged by the administrator (policy driven).

Oracle also supplies a number of out-of-the-box reports that display historical analysis information about processes, process instances and activities etc., including:

- **Process specific statistics**—such as hourly, daily, weekly statistics on number of completed, waiting, failed instances, min/max/average time taken by instances of this process.
- **Activity specific statistics** for each process—activity name, type, min/max/average time to complete.
- **Process reports specific to external/partner interactions.**
- **Performance statistics** for each process relative to predefined SLAs.

Users can also build their own custom reports using the monitoring API as well as the database views provided.

The BPEL Process Analytics Console is used to monitor business processes that may span multiple BPEL processes. This console is static and delivers useful information about SLAs, process metrics, and exceptions. It does not provide real time dash-boarding or corrective action capabilities.

Oracle BAM (Figure 13) provides the infrastructure for building real time business dashboards that can capture events from many heterogeneous systems including BPEL Processes. It allows users to configure actions, notifications and alerts based on KPI thresholds. These actions can include starting a BPEL process to take corrective action, closing the loop on overall business process management.

When building process definitions, developers can specify monitoring via “Sensors” at any activity in the process. The Sensor pulls information from the set of variables associated with the process instance and publishes it to an Analytics application, a BAM application, JMS Queue/Topic, or Database. A “Custom” option is also available to support interaction with virtually third party application.
Interoperability with Oracle Business Activity Monitoring provides advanced real-time process analytics

The job of the Sensor is not to process the data—it merely captures and stores it. Furthermore, the Sensor concept is independent from the BPEL process definition itself. The BPEL Designer creates a separate XML document which is overlaid on the process definition. At runtime, the Oracle BPEL Process Manager interprets the Sensor document alongside the BPEL process description.

The bundled Analytics capability is comprised of a JMS client to receive the information, the core Analytics Engine and a console to build the KPIs and create the dashboard. So, for example, if you wanted to measure the time taken between two activities (say the point the process was created and some task later on in the process), the developer would create a sensor for two different activities. Then,
in the BAM tool or bundled Analytics environment, the metric would be calculated as the difference between the two timestamps.

An audit trail is maintained for each process instance. In addition to the standard activity and message audit information, the user may add custom audit information to the log. The log for any process instance is viewable through the administration UI.

10 Templates and Frameworks

The demos and tutorials included with the product provide a wide range of patterns that can be leveraged and developed further. As described earlier, a number of workflow patterns are directly supported and are readily combined and specialized to reflect processes.

Perhaps more importantly, in the near future we will see Oracle’s range of business applications redeveloped in a more granular fashion to leverage the power of the SOA infrastructure capabilities delivered by Oracle BPEL Process Manager. This will enable firms to pick and choose application components and develop on top of them, molding their own application environment as needed.

11 Vendor

Oracle was founded in 1979 and now has some 50,000 employees. Its revenues for the fiscal year 2004 were over $10B.

12 Cost

Oracle BPEL Process Manager is priced at $40,000 per processor (named user licensing options are also available). It is also available as a $10,000 option to Oracle Application Server 10g Enterprise Edition (name user licensing also available). Note that this price includes the bundled Oracle Business Rules engine.
1 Product Overview

Pegasystems SmartBPM Suite includes PegaRULES Process Commander, Process Analyzer, and Process Simulator, as well as a collection of optional application modules. PegaRULES Process Commander (PRPC) provides a rather unique approach – certainly when compared to the other products we reviewed in this study – unifying the notion of Business Process with that of Business Rules. PRPC supports both procedural rules and declarative rules, bringing them together in a sophisticated execution environment. Processes are themselves rules, and rules govern processes. Indeed, virtually everything in the environment is defined in terms of rules; there are over 80 different types, some related to the business process, others to the environment and security.

The net result is what Pegasystems describes as Change-Aware™ Processes: They incorporate the ability to incorporate readily a support for changing business objectives and for having systems that are aware of the changes and respond appropriately. In contrast to other approaches that rely on a static engine that executes defined business processes, PRPC assembles at runtime a combination of the most appropriate business rules and business processes, adjusting the environment to support the specifics of each case. When work is received, the system automatically evaluates the rule base and dynamically assembles the optimal processes, decisions, and data sources for that particular piece of work. To achieve this, the product supports both forward chaining of process fragments (procedural logic) and backward chaining (goal-based logic) where the engine detects that something may be missing or required for a case of work, and invokes an appropriate rule (process fragment) to gather the information.

Furthermore, rules (and processes) are stored as specialized layers of instructions that are given a situational context within which they will operate. For example, imagine that the business has a standard, baseline way of processing orders. But if an order comes in from a key customer and that product is out-of-stock, the firm may want to offer some special alternative. Or it may be a first-time customer within a given geography, and a directive from on high may have designated that a special set of satisfaction checks apply to such a customer. PRPC handles the varied situations by layering-on specializations to the rule base, effectively adding differences without having to go back and manually weave these revisions into the baseline process. The approach enables firms to specialize the ways processes, decision rules, and data sources will work. The engine then determines which set of processes, rules, and data sources apply best in every situation.

The end result is a framework that organizes business thinking into an open, relational rule base. The rule base is built by integrating and specializing, where each new rule adds a specific aspect or refinement. As specialized rules are added, they are automatically slotted into the procedures and the decisions they impact. This automatic positioning is more efficient and error-free than the typical choice – the laborious locating and coding of discrete changes across dozens of separate modules. Moreover, this technique eliminates the effort and risk associated with predicting which code elements will change frequently, or with having to manually decipher, embed, and disseminate required changes. It also facilitates the adaptive discovery of process or policy changes, as business owners and analysts can apply new rule sets to a case of work after it has been instantiated.
2 BPM Engine

The core of PRPC is a J2EE compliant engine that combines both a Business Rules Engine (BRE) and the Process Engine. PRPC relies on application server clusters to support large enterprise applications. It runs as a series of loosely coupled nodes that bring the execution of processes and rules in close proximity to the requesting user or system. Nodes can run within application servers. In fact, PRPC can run completely within the Web container tier; completely within the Enterprise Java Beans (EJB) container server tier; in a combination of both; or completely embedded within larger Java applications (executing in the same JVM and invoked through a Java API).

Supporting that environment is an XML Clipboard – a sort of runtime cache providing the Shared Data Space for work handled by the system. Underneath that are a number of server components that look after performance alerts, security and access permissions, third party database access, etc. The Performance Monitoring subsystem provides options for both the system and the business process performance. Perhaps the most interesting of these components is the Context Management subsystem. (See Shared Data Space on page 204.)

All the rules and work objects in PRPC are stored in underlying Java Database Connectivity (JDBC) compliant databases such as DB2, Oracle, or SQL Server. All modifications to the rule sets and work objects are under database transaction control.

2.1 Platforms

The system runs on Windows, Solaris, Linux, AIX, and z/OS. Pegasystems can run within J2EE compliant application servers (especially WebSphere and WebLogic). However, it does not require an application server; the architecture can run embedded within Java applications (via the JSR 94 API). PRPC can also run concurrently on multiple application servers using the same rule/process engine and work database.

2.2 User Interface

The portal type user interface provides access to work in the system. Each user is assigned an access group. Whenever an assignment is made to that user, the work item goes to a router, which brings up his or her rule form to assess what he or she is allowed to see and do. Out-of-the-box, there are many different layout defaults available, with a wide variety of HTML gadgets that can be added and deleted.
without programming. This approach allows developers to easily hide, or to add, functionality to a group’s portal. Compliance to the JSR 168 specification allows all PRPC functionality to be embedded in other portal environments.

The out-of-the-box views can be modified, and are controlled by cascading style sheets to ease customization of look and feel. More importantly, what users see when they are managing work depends on the situation, their need, and rules-driven processes. Under the covers, these views are composed of elements of predefined HTML functionality that provide rule harnesses. These variable elements are configured and dynamically put together, depending on where the user is in the process and on their predefined capabilities.

2.3 Scalability

PRPC can scale both vertically (small through large numbers of users) and horizontally (the ability to spread applications and work across the organizational network). The architecture supports multiple servers running concurrently on multiple operating systems, all using the same rule base and work database. Each node in the cluster operates independently from the rest. Only the data is shared. The system provides facilities to partition the database across physical servers to prevent a bottleneck. The databases supported include SQL Server, Oracle, DB2, and other DBMSs that have JDBC drivers.

Server volumes vary by processor size and CPU speed. One account reported ~70 million rule invocations per hour running on a single 8-way Intel server. The largest number of concurrent users on one production system is around 10,000.

3 Processing Modeling

Developing systems in PRPC is quite different from the other products we assessed. Within PRPC, a Flow Rule defines and represents a business process (workflow), orchestrating and managing the steps and assignments involved in driving work towards resolution. Diagrammatically, these Rules consist of a network of shapes and connectors (lines), each of which has associated parameters, values, and functions. Based on the type of shape and connector, the Rule determines who can work on a Work Object, in what sequence, with what decisions, etc.

A Work Object is a task or a collection of tasks that people or systems complete to resolve an overall assignment. Each Work Object can contain many roles and constituents in order to complete the assignment.

Work Party Rules define which roles can participate in a Work Object. Some work parties are known simply as interested parties, whose participation means only that they are kept informed as the work object progresses to completion.

The development environment is itself integrated into the same user interface employed by end-users to access the system. This enables the overall Business Rules system to be turned in on itself – controlling what developers do and see (controlling access); which guides or wizards are provided to them; and the processes that they go through to develop and deploy applications.
Figure 2. Each shape in the Visio modeling environment defines the type of rules associated

The domain model and the rule-based fact mode, that make up the underlying class structure of the SDS are also developed, tested, and managed in the same environment. Developers then leverage this object-oriented structure in the rules management environment. Pegasystems enforces strict semantic naming conventions at the creation of the underlying classes, and this naming empowers business benefit through inheritance and reuse.

Moreover, the presentation layer itself is tightly integrated into the development environment, making it easier to change the look and feel, while ensuring end-user ergonomics. All constituent components, including presentation logic (HTML forms, for example), properties and attributes, and rules, share the same object-oriented environment. PRPC also provides a range of design time tools, including a Process Rules Explorer and unit testing functionality, enabling developers to see the impact of changes on processes and rules as they develop them.

It is also possible to import Visio diagrams and to map an existing notation or methodology to suit the smart shapes of PRPC. In a sense, the Rule Engine looks at the foreign shapes, and, if it does not understand a shape, it asks which rule to link it to. In this way, pre-developed functionality can be assigned its own graphical representation and reused as necessary. So, a shape in Visio is not just a graphical object, but also has a rule associated with it. In turn, that rule might invoke other rules or processes. Moreover, the methodology employed in development is also supported and adaptable in the same environment. As new approaches are developed, they are reflected in the way that developers use the system. Documentation is automatically generated, including all rules and processes associated with the subject domain.

3.1 Subprocesses

A key aspect of PRPC is its support for dynamic layering of specialized rule sets and process flows. These layers follow a pattern of strong inheritance in a way that allows firms to handle the most common circumstances, local variations, and time-based rules and processes, all the way to individual customer-specific rules. Depending upon the circumstance, therefore, a specific set of specialized subprocesses and specialized rules are triggered and fired automatically.

Both synchronous (trigger) and asynchronous (spawn) modes are supported along with the ability to chain processes together at runtime. Furthermore, the multi-dimensional Context Management features of the engine assess which process fragments to bind, based on attributes of the case.
Subprocesses are either nested or called externally. Subprocesses are represented by special flow shapes, which are, in turn, linked to either external or internal subprocesses. PRPC even permits developers to embed their own external Java applications into its environment, calling them at runtime as part of a process trigger.

3.2 Shared Data Space

Context Management environment provides a semantic structuring of the Shared Data Space to enable situation-based rule resolution. This works across six different dimensions, most of which support inheritance, both pattern-based and directed. The result is much more flexibility in inheriting function and data across processes:

- **Product or Service taxonomy** – an inheritance structure of products and services. For example, the rule might apply only to the mixed Mortgage, Loan, and Savings Account, which inherits properties from all three parent product categories.

- **Customer Category** – defines the type of customer that the case relates to. For example, a simple classification might be Gold-Silver-Bronze.

- **User** – defines where the user fits within the organizational structure.

- **Locale** – defines the geographic location that the rule relates to. For example, the account might only be applied to customers residing in Central London (which might inherit from those available in England).

- **Time stamped** – defines the time period in which the rule applies; for example, mortgage applications taken out between April and June 2004.

- **Versioning** – assesses which version of the rule set is to be applied. This is akin to the specialization of the rule set over time (a dynamic layer rather than a versioned file).

3.3 Forms

Apart from the browser-based forms environment, third party electronic or PDF forms can be used. Inside the PRPC environment, forms define concepts that drop into the rule base in bite-sized chunks. Developers can drag properties from the property list of, say, an integration rule onto a preview of a
user screen. When the screen is saved, the property is automatically embedded where it was dropped. The system includes an extensive library of special HTML forms that are, in fact, rule harnesses. This can be used immediately to express the application in a portal (PRPC supports the JSR 168 portlet standard). Developing a user workbench for a particular vertical market application implies capturing that application’s semantics, terminology, rules, and typical process flows.

3.4 Time

Within PRPC, time assignments on Tasks, Subprocesses, and entire Processes are managed with Service Level rules. These rules are used to automate the way businesses define, monitor, and manage assignment goals or deadlines. Where appropriate, they escalate work to meet these obligations to customers. When a time interval defined by a service level passes, without the assignment being performed, escalation occurs. Service level rules also enable notification and management with a variety of means such as e-mail, pagers, or automatic transfer of work.

Service Level rules are usually established for task deadlines, with three different pre-defined levels of escalation: Goal – the desired amount of time to complete an assignment; Deadline – the maximum amount of time allowed; and Late – a post-deadline late period. Against each of these different states, design time rules (escalation actions) are established to ensure that work is expedited appropriately. These states are also used in process monitoring and quality metrics.

If needed, further sophistication can be achieved by enhancing the Activity rule to include additional states.

3.5 Process Optimization and Simulation

PRPC includes a bundled, discrete event simulation tool. Typically, it is used to test assumptions about how work throughput is affected via process and rule changes.

4 Business Rules

During development, rules are accessed in the Manage Rules area via a simple tree view that provides the ability to focus on the developers’ own specific rules, on all the rules, or only on those rules that are pertinent to a specific solution. The tree view sorts rules via several broad rule categories, including Property, Process, Decision, Portal-and HTML, Simulation, Integration, Organization, and Security. Rules are edited and updated in web forms and are checked in and checked out (no third party CVS is required) with strict control over who can touch which rule when.

Figure 4. Decision Tree rules are built up using an if-then-else construct related to the underlying class structure (shared data space) of the work.
Logically, one might think of four categories:

- **Declarative Rules** – a set of rules that use dependency networks to compute values or enforce constraints as other properties change, ensuring that data remains consistent.

- **Decision Tree Rules** – a family of rules that makes fact-based inferences to process if-then logic statements.

- **Process Rules** – graphical representation of design flow-logic. These rules graphically depict and manage the chronological order and work assignments for a specific system request or task.

- **System Rules** – rule-based enterprise integration facilities that enable systems integration, the data transformation that automates data mapping, and parsing between disparate systems.

From a rule processing point of view, PRPC allows both forward chaining (procedural logic) and backward chaining (goal-based logic). Forward chaining is what we commonly refer to in procedures; facts are entered (for example, age, gender, type of car) to make a decision (for example, should the auto insurance policy be granted?). On the other hand, backward chaining utilizes dependency networks: PRPC determines known and unknown dependent facts. For example, when evaluating an expression or constraint, if a required fact is not available, PRPC invokes goal-seeking logic to compute that fact from other known values. It retrieves or computes the missing value, either by interacting with other enterprise systems or by asking a user to supply the value. Once that fact is known, it is automatically used to continue the evaluation of expressions or constraints until the final value is determined.

Business rules are defined in near-English expressions, in decision trees, and in decision tables, and the rules include declarative rules as well as procedural rules, constraints, and service level agreements:

- **Decision Trees** record a complex if-then-else logic that calculates a value or triggers an action in a simple-to-understand format. For example, you can use a decision tree to determine who approves varying amounts for purchase order requests within an organization. See Figure 3.

- **Decision Tables** are used to derive a value that has one of a few possible outcomes, where each outcome can be detected by a test condition. A decision table rule has two or more rows, each containing test conditions and a result.

- **Map Value** rules simplify decisions, based on ranges of one or two input values. These rules enable you to create a table of numbers, text, or date ranges that convert the intersection of one or two input values, such as latitude and longitude numbers, into a calculated result value, such as a city name. For example, a map value rule is used to determine if a new employee is given a cubicle, a shared office, or a private office, based on the intersection of their department and salary grade.

- **Declarative Expression** rules are used to define automatic computations of property values based on declarative or mathematical expressions. The rules engine automatically computes the target property values each time any of the other values in the expression change, or whenever a value for the designated property is accessed.

- **When** condition rules are used to evaluate Boolean logical statements involving values of properties in order to return a value of true or false. For example, a When condition could be used to validate whether a returned product is still under warranty or has been recalled.

- **Declarative Constraint** rules define and enforce comparison relationships among property values. These rules can provide an automatic form of property validation every time the property value is accessed. For example, a constraint rule might be used to validate wholesale pricing. The rule states that when the wholesale property has a value, it must be less than the retail price value. Otherwise, the rule displays the message “Pricing Error” within the wholesale price property.
• **Declarative OnChange** rules run a specified, automated activity if a tracked property changes value. Declarative processing is based on changes to the value of a tracked property. On the other hand, declarative expressions actually change the value of a target property, and declarative constraints change the state of the target property.

• **Declarative Trigger** rules enable an automated activity to run whenever instances of a particular object class are created, updated, or deleted in the database.

The system also validates all flows, constraints, and rules as they are created, to ensure they are well formed. It also provides visualization tools to spot where errors might have been introduced. Rule authors add properties, set potential results, set restrictions, and include out-of-the-box functions or other custom functions added by customers. Rule authors can also set the pages and classes to which the rule is associated and review the audit trail and update record to track who has checked out the rule and when.

![Figure 5. SVG Viewer for the declarative rule network – can be used to verify and visually validate that the rule is firing as it should](image)

The developer can also test and analyze the declarative network. In this case (Figure 3), a new value for dispute amount is being suggested to test the result.

Rules in the system are translated to XML and stored within the rule repository. They are called as required, going through a first time assembly process where they are compiled into Java executables. PRPC maintains a cache of frequently called rules to ensure high-volume throughput. Rules are also used to cover the distribution of new applications, while wizards support their import.

## 5 Integration

PRPC supports a wide variety of integration options, both when embedding other applications inside its processes and when exposing Pegasystems applications to other systems. Out-of-the-box, the product leverages virtually all applicable standards:

• **Services** (exposing Pegasystems applications to other systems): BPEL, COM, CORBA, EJB, email, JSR 94 (Rules), File, JMS, .NET, SOAP, and Portlets (via JSR 168).

• **Connectors** (introspecting third party functionality to embed it within Pegasystems applications): BPEL, EJB, JMS, Java, MQ, SOAP, and .NET.

Again, PRPC utilizes extensible rule-based forms to streamline the creation of Connectors, Services, and APIs. These context-sensitive development tools guide developers in mapping parameters to external systems. The technical purpose of these rules tends to require that the system architect have a strong understanding of the company’s security model, application data schemas, and system integration strategy. As with the business rule forms, these rules require no programming.
6 Organizational Structure

Pegasystems does not attempt to maintain synchronization of an internal organizational structure with the external user authentication databases. Instead, it supports external authentication via LDAP, and it creates internal operator authorization information, as required. This approach removes unnecessary overhead and enables the maintenance of user accounts in a single external source. The system can supplement user data with additional role information for authorization and access to classes or individual objects.

Skill-based rules are used to describe and define proficiency ratings necessary for a user to complete work. With these rules, managers and administrators can associate skill levels with individual operator IDs (ranked from 1-10 against a defined skill). At runtime, Routing Rules, attached to tasks within a process, compare user skill levels with the requirements of the application to ensure that the right person for the job is selected to complete the task.

7 Process Adaptability

As one would expect, authorized users can move work to another point in the process or reroute work to another individual. Pegasystems also provides templates that facilitate customer case handling, where users choose the appropriate process fragments to apply to given customer situations (in an ad hoc fashion). Moreover, one should not forget the power of backward chaining. This feature enables goal seeking based on the circumstances of the case, triggering the right rules and processes as needed.

Finally, if a work item that seems to imply a change is required in the process or the related rule set, it is a relatively trivial exercise to modify the affected rule set and have the case then follow that new pattern. To institutionalize this approach would require design of a mechanism to defer work items to a special workbasket that would route the item to the relevant rule owner.

8 Process Lifecycle

PRPC provides an environment that dynamically manages models as a set of layers that are interpreted based on a multi-dimensional context. This creates an effective, fluid matrix of business models; each layer or specialized version of process rules is kept safe from the changes. As a result, business process development can occur incrementally as change requests, improvements, competitive imperatives, or executive policy guidelines change.

PRPC’s support for inheritance and specialization of models (rules) enables rapid development of new products and services, allowing developers to focus on the specific needs of the new product.

PRPC validates all flows, constraints, and rules – as they are created – to ensure that they are well formed. As mentioned earlier, the product offers strong visualization tools to spot where errors might have been introduced and to help process and rule authors/stewards/owners to navigate to them quickly.

9 Monitoring, Measurement, and Management Information

Process Commander has extremely flexible out-of-the-box reporting capability, with wizards to assist business analysts in defining and refining custom reports. The Process Analyzer tool provides business activity monitoring to visually represent work latency, delayed tasks, workload capacity, and so on. These reports are dynamic windows onto the work in the system. These data can be analyzed further with Process Simulator to predict the effect of different scenarios on the organization.
In addition, Process Analyzer gives many standard OLAP reports that can be customized and embedded in the portal dashboard. Pegasystems supports several OLAP cubes to analyze the performance of users, processes, work queues, and more.

![Image of Process Dashboard]

**Figure 6. Example of the Process Dashboard**

## 10 Templates and Frameworks

Pegasystems provides a wide variety of optional process templates, including Case and Event Management process templates, Compliance (SOX) process templates, and over 30 out-of-the-box, pre-built process templates, to accelerate the creation of process-enabled applications for horizontal industries.

Financial Services Industry Templates:

- **Case Process Management** – integrates with back-end systems to automate processes behind the scene such as account updates, fulfillment requests, dispute processing, address changes, complaint handling, etc..

- **Case and Event Management** – manages and orchestrates case management, tracking, routing, etc., based on any number of factors such as compliance or fraud issues.

- **Quality and Exception Management** – automates complex processes such as data and image retrieval, research, case resolution, sub-ledger accounting, and automated correspondence.

- **Retail Banking Process Template** – manages and governs payment exceptions across a variety of payment types and customer contact channels within the retail banking industry.

- **Wholesale Banking Process Template** – manages exception management, service level monitoring, and escalation alerts customized to the needs of wholesale banks.

- **Credit Card Process Template** – automates and manages credit card disputes and ensures that credit card providers comply with corporate and government regulations.

- **Smart Adjust Process Template** – automates the research and adjustment process of various types of bank payment exceptions.

- **Smart Monitor Process Template** – management process template that automates service level agreements and exception management, and monitors service quality.

- **Smart Dispute Process Template** – guides banking staff though tasks associated with dispute processing and resolution, automating tasks when possible and guiding staff when human intervention is necessary.
• *Smart Investigate Process Template* – automates transaction investigations and exceptions management from initial contact through resolution.

• *Image Manager* – manages the retrieval and distribution of digital images for paperless processing environment across the enterprise.

Healthcare Industry Templates:

• *Claims Automation* – manages and facilitates straight through processing of health claims.

• *Claims Repair* – process template for automating the entire claims process from pre-adjudication through claims finalization.

• *Member Service* – automates service functions such as claim inquiry resolution, and ordering ID cards and enrollment forms, etc.

• *Provider Service* – automates service transactions, wherever possible, and routes and guides work to skilled workers when human intervention is necessary.

• *Service Manager* – manages the customer's service process between all healthcare participants: members, providers, brokers, and employer groups.

11 Vendor

Pegasystems Inc. is a public company (PEGASYSTEMS) and was founded in 1983. It has around 420 employees in 11 offices worldwide and has annual revenues of around $100 million. Pegasystems has approximately 110 customers of which about 25% are already using PRPC. The company focused traditionally on Financial Services and Healthcare, but has now broadened its customer base to include Telecommunications, Travel and Hospitality, Government, Retail, Manufacturing, and Utilities.

12 Cost

Pegasystems software licensing for its SmartBPM Suite starts at $100,000. Optional modules for simulation, analysis, and templates are priced separately. Because of exponential increases in throughput, due to software performance improvements, the company is currently moving to a utilization price model, based on rule invocations.
1 Product Overview

The Singularity Process Platform (SPP) supports the entire lifecycle of business process management, from initial modeling, through execution, monitoring, and optimization. Singularity differentiates itself through its focus on eliminating the need for software coding (everything is configurable), support for self-optimizing processes, the product’s ease of integration, and an overall emphasis on accelerating ROI. Singularity has also sought to reduce the time needed to deploy new processes through more effective screen design, report design, system integration, and data integration capabilities.

Designed from the ground up for the Microsoft environment, the SPP exploits .NET, COM+ technology along with open standards such as Web Services and LDAP. The product integrates and builds on the broader Microsoft product range, including SharePoint, Live Communication Server, Visual Studio, Office, Visio, etc. However, the product is generally deployed in heterogeneous environments.

Singularity has adopted a Service Oriented Architecture for the product – one that they refer to as their Services Everywhere Architecture. In SPP, everything is a service: Each subcomponent of the Platform can be called as a service by a third-party component (call-in). Every service can call other services: Each SPP component can extend, alter, or substitute its service fulfillment by calling other services (call-out). Each service can modify its behavior by calling other services within the platform (self-call). Service orchestrations are themselves services. SPP orchestrates the sequencing of service provision into processes. All processes are available as services, and any service can be fulfilled by calling a process. This approach ensures support for the formal design goals of the system. These include the provision of an environment that was open, stateless, interoperable, multi-channel, multi-lingual, fault tolerant, and scalable.

The modeling environment supports simple point-and-click integration to external systems, with automated support for call outs to Web Services, and a simple data access wizard to guide business users through data integration steps. Work routing capabilities include fine-grained control navigating up or down organization hierarchies based on resource utilization, staff availability, skill set, or priority. The incorporated simulation environment can utilize live and historical data, and different versions of processes, simulated in parallel to compare relative costs and efficiencies, with output to Excel and other applications for subsequent analysis.

In Release 3.0 of the SPP, a new Business Activity Monitoring add-on employs an “Event Manager” to gather Key Performance Indicator measurements during execution, and then display this information in user-configurable dashboards. Further, in line with Singularity’s focus on facilitating business ownership of business processes, a new Forms Generator enables business users to design the work queue and other process entry and display forms, using simple drag and drop techniques. This forms tool exposes process related controls and data items, simplifying screen design, and, as a result, reducing deployment times. The product also provides sophisticated version control and release management capabilities. A process catalogue enables the sharing and re-use of processes.
2 BPM Engine

The Singularity Process Platform is composed of four core components:

- **Builder** – the process-modeling component, which also contains the simulation environment.
- **Driver** – the runtime process engine.
- **Monitor** – an event-oriented process monitoring and alerting component.
- **Optimizer** – the process optimization component.

The Driver component is a robust and scalable process execution engine. Processes are executed according to the business logic, rules, policies, and resource profiles specified in the map created using the Builder modeling component. The Driver guides process execution toward completion, orchestrating the combination of system and human activities. Reflecting the dynamic environment in which organizations operate, the Driver can react at runtime to changes in throughput, capacity, workload, and utilization to modify its scheduling and routing of workload and process tasks. As exceptions occur, it can launch new processes to rectify the cause of the problem (without manual intervention).

Technically, SPP has a modular, n-tier multi-threaded architecture. Each component implements a separate service, encapsulating a distinct aspect of the functionality. SPP comprises a set of stateless components, with all operational data and business relevant data managed within an enterprise database or multiple databases.

SPP communicates with external systems through standard protocols such as COM+ or .NET. These external systems could include legacy applications, third party Web Services, or other instances of the Singularity Process Platform.
SPP has in-built support for Web Services, including an online discovery facility. It also provides comprehensive support for XML, including a small XML parser. Examples would be including a Web Service call to a credit card authorization company, or the retrieval of delivery information on a dispatched order from a transportation partner. The XML parsing facility identifies the pertinent information.

### 2.1 Platforms

SPP supports the Windows Server 2000 and Windows Server 2003 platforms (Singularity is a Microsoft Gold Certified Partner). Design-time client components that are not browser-based support Windows XP and Windows 2000. All other client components deploy on any platform that supports standard internet browsers. From a database point of view, SPP supports SQL-Server and Oracle. Practically speaking, any ODBC compliant would suffice.
2.2 User Interface

There are two sets of client elements – those used by process designers and business analysts at design-time and those used by process participants (workers) at runtime. Workers only need an Internet browser. During process execution, users interact with business processes via browser-based work queues, or browser-based portlets (known as web-parts in Microsoft’s portal system, Sharepoint). SPP fully integrates into Microsoft Office, so users can also interact with processes via Microsoft Outlook and other Office applications. The Business Activity Monitor also utilizes a browser-based interface for monitoring the operational performance of processes, including a user-configurable dashboard.

At design time, process designers use a rich-client, graphical modeling tool (Builder) that also supports multi-user access. Screen designers use the Forms Generator component, which is a Windows client for forms design. Once satisfied with screen layout, clicking on the ‘deploy’ button automatically generates web-forms. SPP can also deliver information to users or applications, using Web Services, COM+, and .NET Enterprise Services, across multiple channels including SMS, email, and Instant Messaging.

![Figure 3. The primary user interface is via a browser-based access to the Sharepoint-based Portal environment](image)

2.3 Scalability

SPP has a modular, stateless, multi-threaded architecture that allows for additional processing components to be added as demand increases. It also fully exploits the capabilities of Microsoft’s .NET environment to support clustering, scalability, failover, and load balancing. Requests from the application to the database layer are mediated by server clustering technology to distribute accesses to the database servers. The database servers can operate in either active-active mode or active-passive mode.

It is possible to have a number of Driver components set up on multiple machines. Load balancing is handled either by hardware or Microsoft .NET Network Load Balancer (NLB), which passes the work to an available Driver. Microsoft Transaction Server (MTS) enforces transaction commit and rollback at the activity node within a process map.

SPP also supports the capability to set up a “Thread Pool” that can then be given priority over other work on the server. At design time, processes or specific steps are assigned to the Thread Pool, providing the ability to ensure performance for specific parts of the process, while other, less important phases of the process execute more slowly.

Since SPP is a stateless system, the state for each process step is stored in and retrieved from a database. This increases the system’s availability and reliability – if a state was stored at the SPP server, when one server failed it would disrupt the processes of all connected clients. Instead, if an SPP component fails,
the load balancer redirects the clients to the next available server, which picks up the state from the database layer.

3  Processing Modeling

The Singularity Process Platform’s Builder component provides a visual modeling environment for process designers and business analysts. The Builder can also import previously created process maps from Visio and other modeling tools. The modeling environment supports multi-user access and integrated process version and change control.

To create a process map, the designer opens a blank map, clicks on a palette to select an activity, and then drops this onto a node on their map. An activity is an individual step (service) that forms part of the business process, e.g., to get customer details. An activity in a process map can have various uses: a call to an automated script; a form to invoke; a call to a third party application; a request to a mail server to generate an e-mail, etc. The designer selects the type of activity that a node represents (a manual task, a Web Service, a scripted activity, an XML activity, a COM+ activity, etc.), and links it to others using a drag and click technique.

The designer specifies the resources (human and system) required for each activity node. This information supports the routing of the process instance based on factors such as cost, utilization, resource availability, staff-skill set, or priority of the case in hand. The product also supports sophisticated routing needs via an Advanced Workflow Rules capability. For example, this feature might be used where three out of a possible group of four are expected to review a document (either sequentially or in parallel); members of a group must be specifically excluded; or the instigator of a process instance must be excluded from an approval task; etc.

Using an integrated “Web Services Tool,” designers can discover Web Services on the web and then register these within the SPP environment. The expected parameters for the service are automatically identified from the WSDL description of the service. Using this tool, designers build up a catalogue of Web Services, which are then available for use when designing process maps.

SPP also includes comprehensive XML support through an XML parser (part of the standard XML node). As a result, the system can manipulate XML documents directly without the need for 3rd party
components. For example, the system could identify the City from the XML address information returned an online Zip code locator. Similarly, the Builder component includes a Data Access Wizard that enables designers to specify a query to a database and include this in their process maps without requiring technical expertise.

Configured activities (and process maps) that are particularly useful can be stored in SPP’s library for re-use in other process maps. Designers can drag-and-drop maps and activities from the library into their current maps. The process models themselves are stored in a proprietary XML format (relatively easily changed to another structure).

3.1 Subprocesses

The Builder modeling environment provides a number of standard mechanisms to leverage subprocess concepts. Subprocesses are embedded at design time, or dynamically identified and called at runtime. The platform supports both synchronous and asynchronous (fire and forget) calling of subprocesses.

“Nested” process maps are inserted as a single node into another map and are usually employed when the initial process map is getting too large, or if the designer has identified a process that may be re-used in other maps (as a first step toward supporting re-use). This may also apply in situations where work is carried out by another department or another company.

A “Sub Job Activity” calls a subprocess as part of the parent process and exchanges input and output variables between the parent and sub-job. It also enables a number of instances of the sub-job to be initiated at the same time. Advanced Workflow Rules, mentioned above, can be applied to the entire sub-job.

Finally, a process can be invoked at runtime – this is known as dynamic process invocation. This is the method used by the runtime Event Manager to respond to exception events (e.g., job time overrun), by invoking a related process to rectify the exception, depending on the particular circumstances. The exception processes are defined at design time, but the selection of the appropriate exception process is made at runtime.

In addition, SPP processes may be published as Web Services and, therefore, could be called by other processes.

3.2 Shared Data Space

Using the Builder, designers define local and global process variables. The scope of the variable can be limited to the current process, to the current and all child processes, or to the entire process space. These variables can include the declaration of arrays. Designers create variables one at a time, which may then be associated with elements of an introspected Web Service. Process maps and variables may also be given a “Category,” which is used to help separate different types (see Figure 4).

3.3 Forms

SPP provides a Forms Generator component as part of the Builder design-time modeling environment. The Forms Generator is a wizard-driven tool, which gives designers the ability to quickly and easily create and deploy customizable forms for business solutions, without any technical expertise. It provides an automatic generation facility, as well as the ability to customize forms in the tool’s Integrated Design Environment. Further customization is possible in Microsoft Visual Studio with all the relevant plumbing and code automatically generated.

For example, a Business Analyst can generate an entire solution with multiple work queue pages, new case (process instance) pages, a case (process instance) properties page, and all corresponding activity pages without resorting to code – i.e., select a business process map and automatically generate the required pages.
The forms tool provides “plug-ins” (adapters) to enable the translation of third-party form definitions into a Singularity format. It is also possible to use third party forms packages, although these may not provide the process-specific supports available in the Forms Generator.

## 3.4 Time

SPP handles time at a number of different levels: during design-time specification of expected performance; during run-time monitoring of performance; and in the scheduling of running processes. This can apply at the level of an individual activity or for an entire process.

![Figure 5. Setting expected duration for an Activity](image)

The Driver and Monitor track the actual elapsed time so that KPIs can be assessed. The Event Manager component within Driver traps standard exceptions such as process duration overrun, process cost overrun, activity duration overrun, activity overdue, etc. Exceptions may initiate standard alert mechanisms (i.e., send email or SMS based notifications). Notifications delivery is itself based on a process (and therefore changeable). Exceptions may also trigger another process, which could rectify the exception condition.

As regards the timing of running processes, SPP includes an administrative interface to control how processes execute. The system uses an internal Business Calendar for specifying working and non-working days and standard working hours. It also includes a job-scheduling tool that allows administrators to set up processes to run at regular intervals.

## 3.5 Process Optimization and Simulation

The SPP Optimizer component enables execution-time improvement and self-optimization of business processes. It can execute a process differently, or execute a different process, depending on circumstances – for example, during periods of increased demand. Beyond simple load balancing and optimized work routing, the Optimizer drives dynamic modifications to execute processes at runtime, based on the current state of the system. The Optimizer uses the performance data captured by the Event Manager to determine the current state of the system and activate changes to running processes in real-time. Anything from the priorities, due dates, process routing, or even structure of the process can be dynamically modified.

The Optimizer can be configured to support tactical operational decisions (e.g., use a different process to get rid of a backlog today) or to identify longer-term process enhancements (this process is repeatedly running into problems under these circumstances). Examples of the Optimizer’s capabilities include:

- **Performance-driven Optimization** – Reconfigure any aspect of a process to ensure achievement of pre-defined performance levels (such as cost or utilization thresholds).
- **Revised Resource Allocation** – The Platform supports automatic re-assignment and delegation of work in real-time, dependent on user-defined criteria such as resource utilization, resource availability, productivity, and so on.
Execution-time Process Optimization – The Optimizer enables organizations to automatically add staff and/or computing power or swap in replacement processes when a threshold is reached; for example if the backlog of customer orders reaches 6,000. Non-urgent steps in a process can be temporarily by-passed during peak demand to ensure cases are dealt with promptly.

Load-driven Process Prioritization – The Optimizer can automatically reallocate resources to high priority tasks and de-allocate from lower priority tasks at execution time when demand is heavy, returning to default resource allocations when demand returns to normal.

Builder includes a simulation sub-component called “Simulator.” Simulator is a “wizard-driven” simulation and analysis environment that allows testing and “what-if?” scenario analysis.

Process Designers can simulate the workload of a process by setting up information on expected process throughput, resource costs, resource availability impact, and so on. Simulator returns the test results showing idle resources, etc. Simulator facilitates testing of exception handling and escalation processes, checking for adherence to Service Level Agreements. It can use both live and historical data when running process simulations. The output data can then be displayed, using Microsoft Excel, other Office products, or more sophisticated analytical tools.

Figure 6. Simulation runs are available for further analysis in Excel and other products

4 Business Rules

A Boolean expression editor is included to define business rules at decision nodes within the process. The defined business rule executes using the variables of the process instance. The product is also capable of business rules integration with third party rules engines through Web Services, .NET, or BizTalk. Another aspect is around the definition of exception conditions.

Figure 7. The Advanced Workflow Rules dialog
Rules are also reflected through the Advanced Workflow Rules concept. This facility supports highly sophisticated routing conditions that would otherwise require complex procedural models to resolve. Examples of this sort of functionality include routing work to three out of a possible group of four expected to review a document (either sequentially or in parallel); identifying members of a group that must be specifically excluded; or where the instigator of a process instance must be excluded from an approval task, etc.

5 Integration

The primary integration mechanisms for SPP are Web Services, COM+, .NET, and scripting. Internally, a Process Integration Agent supports these interfaces. Out-of-the-box, SPP can integrate any system that supports either of these interfaces. Different types of activities in the process model support each interface. For example, a COM+ activity might integrate the published API of a third party application. Similarly, a Web Service activity embeds the WSDL description of the target Web Service that provides the required methods. As discussed earlier, developers can build up a library of integration components and re-use them directly in process models. Similarly, a catalogue of Web Services interfaces can be developed.

External applications that need to call SPP services (or its processes) can use the same approach. SPP exposes all of its functionality via Web Services, .NET, and COM+ (there is also extensive API documentation).

In specific cases, Singularity has provided pre-built integration components to vertical-specific applications. For example, Singularity developed a connector for financial securities messaging application used in the investment and asset management industry.

In the Builder, process designers can set a Transactional flag for Activities (or subprocesses). This enables application roll back in case of failure. Effectively this creates a two-phase commit capability to the database. When a subprocess has the transactional flag set, the entire subprocess becomes one atomic entity that must complete successfully.

Singularity integrates also into the majority of Microsoft’s product sets, including the Microsoft Office Suite (for example, Outlook for alerts and Excel for displaying Simulator output). SPP also supports the import of Visio process maps into the Builder, and direct interoperations with Sharepoint Server, BizTalk Server, and Live Communication Server to support Instant Messaging and “presence detection” (using SIP).

6 Organizational Structure

SPP supports the import of user data from Microsoft Active Directory, LDAP, or the existing Windows Domain user-group structure. Alternatively, the organizational structure is built directly within the product. There is strict security control over who can and cannot create resources and set their security levels in the modeling environment. It is also possible to model non-human resources, enabling the routing of work to specific servers or applications.

Groups and Roles are defined, which may also have supervisors and line managers associated with them. Against individual resources, the administrator can record information such as skill level, supervisor, security level, and cost per hour. This information is then available to support routing decisions and overall process cost calculations. For example, designers can specify work routing at a step to go to a particular group, to a staff member with particular skill set or security profile, or even to specific individuals.

A rich set of configuration options is available to determine work routing. Depending on the process definition, the recipient might resolve to the supervisor of the person who worked on a previous step.
(or the individual who created the job); or, alternatively, a specific task may be delivered to all the members of a given role (sequentially or in parallel). Rules can be used to specify that if the original recipient does not complete work within a given time, it will be redirected to a second or third person for completion.

Out-of-the-box, synchronization with Active Directory and LDAP is import only. However, the synchronization is process-based – i.e., it could be modified to support a more sophisticated 2-way update mechanism.

7 Process Adaptability

As discussed earlier, Singularity has developed significant process optimization capabilities in the product. This entails a certain degree of process adaptability at runtime. Anything from the priorities, due dates, resources route of the process, or even structure of process can be dynamically modified by the system. Resources can be swapped in or out, work can be routed differently, and subprocesses can be modified at runtime.

At runtime, every instance of a process map has a unique identifier, as does each activity within that instance that the Singularity Process Platform’s runtime engine uses for orchestration and tracking. If a process instance requires modification, it is possible to change the underlying process model, effectively releasing a new version and then automatically linking that instance to run under the modified version of the process.

Of course, with careful design, invoked subprocesses can be dynamically changed through user selection (in combination with a process variable). In addition, if a subprocess object is modified, any running process instance will by default use the latest version of the called subprocess. With this sort of flexibility, it would be straightforward to develop a comprehensive case handling system.

The solution also supports dynamic process invocation, where one process is replaced by another, or a process is dynamically changed, to reflect current circumstances. A predictive analysis capability is also used, allowing SPP to spot repetitive patterns in the performance data. Together, these features support the self-optimization capability of the system, where SPP monitors the performance of the system and facilitates self-modification of running processes to enhance execution efficiency and ensure adherence to SLAs.

8 Process Lifecycle

SPP supports process versioning, both at design time and during runtime. All design-time process maps have unique identifiers, and version numbers increment during both internal design updates and when released as a complete process map. SPP implements strict access control over who can modify and update process models. The solution maintains all previous major and minor versions of a process model, and supports the deployment of both older and newer versions at the same time if desired.

Singularity provides a range of automated supports for the versioning, documentation, storage, and safe distribution of processes, reflecting our view of processes as corporate assets.

SPP includes a shared process library to support the sharing and distribution of commonly used processes. In the latest release, an automated facility to support the safe sharing of processes by “anonymizing” or stripping out implementation specific details from the process yet still providing a useful map.

The process release mechanism can be set to trigger an event, which itself triggers a pre-defined release process. Customers can configure these release processes – for example, routing the model to the process owner before confirming formal release, ensuring changes are not deployed into the live environment without the proper authority.
In the most recent release, Singularity has added a “pilot versioning” capability, allowing two versions of the same process to run simultaneously. This supports the scenario where a modified version of a business process is piloted in one department, while other employees continue to use the original.

The Builder also includes a Self Documentation facility that dynamically generates information about the process design. Depending on selections made by the designer, this can include general information about process map and detailed information about work queue definitions, resources, activities, and associated parameters. The output is available in Microsoft Word, HTML, or XML formats.

9 Monitoring, Measurement, and Management Information

The combination of events and process variables enables a relatively rich set of functionality for process monitoring. Time periods for individual activities are defined in the Builder component (Timeouts). Process designers can also set monitoring points at any step in a process, specifying the event flags raised. Performance and event data is gathered at runtime. The related business data is also captured and can be subsequently analyzed. All of these data are then available for reporting in real-time.

The browser-based Monitor component provides comprehensive Business Activity Monitoring (BAM) functionality for monitoring processes and viewing performance data. It includes a configurable dashboard and a set of user-definable reports to display real-time and historic performance information.

Customers can configure the Monitor to track a wide variety of business indicators, such as resource utilization, capacity availability, delivery cycle times, cost of execution, etc. It provides real-time performance visibility, including the throughput of systems and the productivity of process participants. This information can be used to identify process inefficiencies, performance bottlenecks, and potential solutions.

In regard to alerting and exception handling capability, the Monitor can be configured to trigger alerts or entirely new processes when pre-defined thresholds are reached. It is relatively easy to set an event flag that triggers whenever there is an overrun of cost or time, at either the process or the activity level. For example, when a backlog of customer cases reaches a specific level or any other exception happens, the system can raise an alert or trigger a new process (to take corrective action).

The event manager functionality of the BAM component is designed to support monitoring of a wider set of applications and services (rather than just inside the BPM platform). It takes event feeds from
external applications via Web Services, .NET, or DB triggers. This allows a holistic view of business operations across the entire organization. Indeed, the BAM component is available as an independent application from the SPP platform.

10 Templates and Frameworks

Singularity Trade Manager is a tailored application designed to support the needs of the financial securities processing market. This solution includes over thirty pre-built industry-specific processes for trade confirmations, allocations, etc., complete with pre-built exception conditions and corresponding escalation processes, and pre-integration to domain-specific applications for financial messaging and trade matching. A customized Monitoring component is also included to track end-to-end trade status. This connects to and monitors third party components as well as the Singularity components, providing a unified view over the entire lifecycle of a financial securities trade.

11 Vendor


Headquartered in Derry, Northern Ireland, the firm employs 180 staff and has offices in London, New York, Hyderabad, Singapore, and Belfast. Projected sales for 2004-2005 are around $18m with growth of 42.5% between 2002 and 2004. The geographic sales split is 60% UK and Europe, 30% United States, 10% Asia-Pacific. Split by industry: 60% Financial Services, 20% Government, 10% telecommunications 5% Healthcare, and 5% other.

12 Cost

Singularity’s standard pricing model is based on CPU and Server usage, the numbers of process participants, and process throughput. Standard and Enterprise level pricing schemes cater for varying levels of client commitment to SPP. Entry-level pricing can be as low as $15,000 for installations with low process distribution in terms of participants, low process throughputs, and no fault tolerance or disaster recovery. Beyond small “Proof of Concept” implementations, which price in the $40,000 to $75,000 range, typical client investments are in the $100,000 to $150,000 range for initial process implementations. Maintenance is 20% annually.
TIBCO iProcess Suite

Version: 10.5

TIBCO Software Inc.

3307 Hillview Avenue, Palo Alto, CA 94304
Tel: (650) 846-5637  Fax: (650) 846-1005
Web: www.tibco.com  Email: jkristic@tibco.com

1  Product Overview

TIBCO iProcess Suite (TiPS), Version 10.5, is largely based upon the Staffware iProcess Engine (iPE) along with additional areas of functionality from TIBCO (TIBCO acquired Staffware in June 2004) and third party vendors.

The product set provides a wide range of BPM functionality, ranging from the modeling and simulation environment, through a highly scalable process engine, into process monitoring and analytics. The various components can be mixed and matched, depending on client objectives.

Key observations include

- iPE supports dynamic binding of procedural fragments at runtime, enabling highly flexible process architectures.
- Enhanced scalability: Tests have demonstrated throughput as high as 7.9m steps per hour. Recent additions in this area include multi-threaded front-end components to extend transaction throughput even further.
- A wide range of integration options allows processes to leverage virtually any third party environment or application. Further options exist for embedding the process functionality in other applications.
- A Process Monitoring & Simulation tool allows users to view workloads (total number of items in a queue, those with deadline conditions, etc.) A Drilldown displays graphical charts, etc.
- The Prediction Service, based on a patented technology, provides users (or supervisors) with a view of the workload expected on a given queue in a given time period. It does this by looking at the process definitions, and factoring historical performance data and existing work in the queue. This approach can facilitate what if scenario evaluation but is primarily used to support human resource decision-making.

2  BPM Engine

The iProcess Engine supports a wide variety of client and server platforms and databases, but, when buying the product, it is useful to think about the suite as shown in Figure 1. At the center of the iProcess Suite, is the scaleable iProcess Engine that manages the state of all process instances. It handles all inbound and outbound interaction whether systems or human oriented. Information associated with Cases, such as form fields and their values, is stored in the shared database (Oracle, SQL Server, DB2, etc.). The iProcess Suite also offers an optional Business Rules manager module and also supports integration with other 3rd party rules engines.

TIBCO offers a process analysis module called iProcess Analytics. This product is the result of a joint development with IDS Scheer and is optional. (TIBCO can also import models developed in the IDS...
Scheer ARIS toolset.) Depending on the goals that a customer has, TIBCO offers a variety of integration options including basic point-to-point application integration to a robust SOA platform for robust reuse and flexibility.

Customers might then use one of the Standard out-of-the-box process clients, develop their own client user interfaces, or integrate the process functionality into a third party application.

Figure 1. A logical representation of the TIBCO iProcess Suite

The core elements of the iPE are shown in Figure 2. Logically, one could think of the iPE as split into three areas – in the foreground are those components that deal with the user interaction, the list of queues and their contents. In the background are the services that perform the processing (working out the next step, etc.). In between them, is the messaging layer that provides an assured transport mechanism between the foreground and background components. This approach also provides a robust transactional management capability, currently supporting Oracle Advanced Queues on Unix, and an equivalent mechanism for SQL Server and DB2. The Sentinels operate in a hot standby fashion, controlling the start up and shut down of server components, and monitoring them to ensure they are running satisfactorily. These components might reside on separate machines or, at the other end of the scale, be grouped together in one machine. Our use of the word component here is for clarity: They are effectively software servers.

Figure 2. The iProcess Engine
Interoperability with other workflow engines is achieved via support for the WfMC interoperability interface (Wf-XML & MIME bindings), and the XPDL standard. This type of support means that a process instance, which is started in the TIBCO environment, can be handed off to a third party Business Process Management environment to complete elsewhere in the enterprise or across the value chain. iPE also supports both inbound and outbound Web Service, using SOAP over http, XML over JMS, and SOAP over JMS with full support UDDI lookup.

Via a Web Services call, 3rd party applications, including 3rd party process engines that support Web Services call outs, can interact with iPE process instances. Through this mechanism, iPE provides support for Case Start/Suspend/Activate, Event Trigger, Jumpto, Delay Release, and Graft Step (allowing new subprocesses to be added dynamically from external applications).

2.1 Platforms

The main server is available on HP-UX, AIX, Solaris, Linux, and Windows 2000/2003 systems. The PC Client on Windows 95/98/2000/2003/XP, with the Web Client supported both Internet Explorer (5.5 or above) and Firefox. All Shared Data Space information and process status data are stored in the iPE database (Oracle, SQL Server, and DB2).

2.2 User Interface

Most users contemplating using the product would probably use one of the Web-based approaches (ASP, JSP, or AJAX), although there is also a traditional thick client. The AJAX (Asynchronous JavaScript and XML) version is a relatively new version of the client, and it offers a rich user experience through a browser. Users can personalize their workspace, and save preferences (e.g. work sort orders). The AJAX version comes with a complete development kit for extending or modifying the client.

Figure 3. The AJAX user client is browser-based

The iProcess Client consists of a Work Queue Manager and a Procedure Manager. The Work Queue Manager displays all Work Queues for the user, customizing the fields displayed as well as how Work Items are filtered and sorted for display. The Procedure Manager controls users’ access to procedures,
ensuring they only see those created for them. Where authorized, the Procedure Manager allows the creation and editing of procedures (launching the Process Definer).

Depending on how Work Queues are configured, work is pushed to individual users (workers receive the next Work Item on the list automatically), or, alternatively, users may pull work from the Work Queue. The push model can dynamically assess priority of the Work Item and the skill level of the individual (defined in the user attributes set up by the administrator).

### 2.3 Scalability

iPE can exist on a single machine or spread across multiple servers in a cluster (sharing the same database instance). With a node cluster, it is possible to share the iPE across several servers to improve load balancing and performance: Applications see only one logical iProcess Server. Further, most of the components are replicable (multiple instances of each), which allows fine-tuning of the configuration. This architecture provides linear scalability with no inherent bottlenecks.

![Diagram](image)

Figure 4. iProcess can also be distributed across server clusters over a number of sites and supports load balancing across all available resources

### 3 Processing Modeling & Simulation

TIBCO has made modeling and simulation a top priority and recently launched Business Studio. This new product is based on the Eclipse framework and it offers a complete modeling and simulation environment built for the business analyst. TIBCO Business Studio supports BPMN and XPDL, and offers a seamless path to implementation of the process on the iProcess Engine. The TIBCO environment supports highly sophisticated process architectures. There are two levels of process – the main process and the subprocesses, both of which are developed using the Procedure Definer. The semantics of the product rely on different step types.
TIBCO avoids the need to write code extending the graphical functionality to cover

- Data design, including user and system-defined fields, attributes, lists, etc.
- Step design, including addressees, deadlines, priorities, etc.
- Integration design, including wizards, data mapping, etc.
- Flow design, including conditions, parallel routing, rendezvous, etc.
- Form design, including client/server and browser-based forms.

3.1 Subprocesses

Subprocesses can be either Static (i.e., fixed) or Dynamic (decided at runtime). It is also possible to nest sub-procedures. Three distinct Step types are used to support subprocesses – the Sub-Procedure Step, Dynamic Sub-Procedure Step, the Graft Step (which allows external applications to select and insert a Sub-Procedure at runtime). Along with the Array field type (capable of storing multiple data elements related to a Case) these Step types extend dramatically the process capabilities of the product. Combined, these Step types enable loosely coupled process architectures – i.e., the parent process need not know anything about a procedural fragment that is linked in at runtime. Subprocesses can then be changed without reference to the parent procedure (but keeping a common information set).

Depending on design choices made, the selection of process fragments to bind can be derived automatically based on the goal of the process or other details of the Case. Alternatively, the system could be set up to allow users to choose from a list of relevant Subprocess to reflect the needs of the case in hand. Depending on decisions taken at design time, the process definition could support multiple process fragments, all dynamically linked to the Case at runtime.
The Procedure Manager is used to support developers as they organize and manage their procedures libraries. The Procedure Manager also facilitates testing, version control, and Sub-Procedure Parameter Templates. These are used as a basis for new subprocesses (ensuring they will work properly with a given parent process). In most installations, it is likely that developers will have a few standard Sub-Procedure Parameter Templates.

Using the Dynamic Sub-Procedures mechanism, the system can be set to goal-seek; i.e., selecting the appropriate process fragment to instantiate, depending on the goal of the process and the data associated with the case in hand. It is only at runtime that the Sub-Procedures to instantiate are determined. Therefore, each possible Sub-Procedure must share the same Sub-Procedure Parameter Template.

### 3.2 Shared Data Space

Along with the usual variable types, TIBCO supports arrays, which can contain multiple data items (e.g., a list of customer names, and/or a list of process fragments for a Dynamic Sub-Procedure step). Facilities are also provided to import the structure of an XML document and also transform that structure XSLT.

If needed, a bridge is available to import ARIS-based process models, bringing with them their defined data structure. TIBCO has also developed a generic import/export wizard for processes. Users can create XLSs for the import of XML based definitions, and then save those transformations for reuse.

### 3.3 Forms

The general approach is for developers to create iProcess Forms incorporating data items (Fields) that are displayed to, or updated by, users. Support is also provided for third party forms applications such as Visual Basic, Oracle Forms, or Delphi.

With the iProcess Forms facility, developers can add any number of Fields to a Form (based on the data structure they have associated with the procedure). Fields are defined as Required, Optional, Display, Calculated, or Hidden. Options are also provided to specify Field level validation and help on the Form itself. Furthermore, it is possible to link individual Fields with third party applications, allowing the user to automatically launch applications such as an image viewer, word processor or other third party application. Scripts are used, if necessary, to execute multiple expressions. It is also possible to control which Fields are displayed depending upon the context. TIBCO also offers a complete form flow capability. This allows developers to build a flow for the forms presentation, while at the same time leveraging TIBCO’s robust integration capabilities to include external data and applications in the form flow.

### 3.4 Time

Deadlines are based on either an absolute time from the start of the task (e.g., 2 hours) or based upon case data (e.g., required time minus 2 hours, or when the case was received plus 6 hours). It may relate to a single Step, multiple Steps, a Sub-Procedure, or the entire Case, and is visible within the Work Queue where applicable. When a deadline expires, the system performs an escalation action, triggering notifications and alarms appropriately. The escalation could also withdraw the original item, decide whether to continue on original path, or launch a new process, etc.

Every Step, and, therefore, every Work Item, has a Priority attached to it. By default, Priority is used to sort a Work Queue. Of course escalation actions can modify the Priority, ensuring that the older the case (or the longer it remains at a particular step), the higher (or, possibly, lower) the Priority.

As mentioned earlier, iProcess now includes a patented feature known as Case Prediction. This enables users to accurately forecast the outstanding Work Items in a Queue and the expected Work Items. In
order to make that prediction, the developer needs to define the expected duration of the Procedure or Sub-Procedure.

The default working week established for the server is taken into account when calculating deadlines. It is also possible to configure the iPE to adopt the same time zone as the clients. This solves the problem where the client is in a different time zone to that of the server. Further, if multiple iPE Engine installations are deployed on the same machine, each can be independently configured to run in a different time zone.

3.5 Process Optimization and Simulation

TIBCO now incorporates a pre-production simulation capability in their modeling environment. This mechanism runs the process model using the engine, calculating completion time and other statistics. This information is then available for analysis and results can be compared across various simulation scenarios. A key factor in the simulation service is that it uses the actual process model to evaluate process conditions and to determine addressees, deadlines, step completion times, and other dynamic aspects of the process flow.

4 Business Rules

TIBCO offers a complete business rules engine called iProcess Decisions. This product allows process developers to remove parametric business rules from process definitions, managing them separately. TIBCO iProcess Decisions is actually an OEM version of the Corticon product that provides a spreadsheet-oriented interface, allowing access and maintenance of rules by appropriate business users. Each decision service is deployed as a Java or Web Service and is accessed via an EAI plug-in within the iPE. TIBCO also supports integration with other 3rd party rules engines.

5 Integration

While it is possible to achieve integration out-of-the-box with simple applications, integrating each application normally requires some programming effort. TIBCO offers a variety of integration options to its users. TIBCO has a long history as an integration vendor and they have closely integrated their BPM suite with their industry leading integration product (TIBCO BusinessWorks).

The iProcess Suite provides EAI Step, which are a plug-in framework to allow integration with any number of external applications, as well as integration with TIBCO BusinessWorks. Technology adapters consist of two components, a runtime plug-in for the iProcess Engine and a design time plug-in for the iProcess Modeler. Available EAI adapters include: SQL Server, DB2, and Oracle Databases; Java; Web Services; Scripting; COM; SMTP Email; and BusinessWorks. The XML-based steps also provide facilities to run XSLT on the imported data to map it onto the defined fields for the case. This plug-in approach provides layers of abstraction to remove the integration details from the business process and allow those details to be managed by developers, and ultimately managed and modified by the developers without impacting the higher level process.

TIBCO BusinessWorks is an integration platform that provides complete support for industry standards and Web services. TIBCO also provides a library of off the shelf enterprise application adapters (SAP, Siebel, Oracle, etc), as well as an SDK enabling additional adapters to be developed either by TIBCO, its customers, or its partners.

TIBCO iProcess Objects expose TIBCO process functionality directly to third party applications. TIBCO iProcess Objects are available as COM, Java, and C++ interfaces. TIBCO also offers server side objects (iProcess Server Objects) that expose the core iProcess functionality as a set of server-side objects, designed for use in server-side, application architectures (Native Java, RMI, EJB, and .NET).
In contrast to Normal Steps that are delivered to Work Queues by the iPE, EAI Steps are executed directly. Since the iPE can run multiple background server processes simultaneously, it is possible for them to be run both synchronously and asynchronously without causing a system bottleneck.

6 Organizational Structure

The organizational structure is reflected using shared and individual Work Queues. A given Role is normally associated with a Work Queue. The User Validation API enables the system to validate user access via an LDAP, X500 or other Directory Server environment. It is also possible to import role definitions and user data from such environments.

7 Process Adaptability

As described earlier, one of the core capabilities of the iPE is the ability to dynamically link process fragments to Case of work on the fly. This enables considerable flexibility in the way in which the process architecture is implemented and, to a certain extent, adaptability at runtime if required.

Secondly, suitably authorized users can change the current Step in the Case, bypassing steps in between, or even moving the Case back again (perhaps to a point where a number of sub-procedures must be redone). However, the process model that supports a given Case cannot be altered.

To maintain a certain degree of control over what can and cannot be done with this functionality, a separate XML document defines the Steps to which the user can move from the current Step. It also defines the Roles that have this capability and any Case data elements that should be overridden. This is saved along with the Procedure definition in the Procedure Manager.

8 Processes Lifecycle Management

Processes defined in TIBCO follow a 5-stage lifecycle – from the development phase, to development and acceptance testing, to operational rollout, and, in the end, final withdrawal. TIBCO implements version control functionality underpinning this lifecycle, enhancing the management and control of process assets. Apart from the expected functionality, administrators can also move live Cases from an older version to a newer version, explore a full audit trail of all process modifications, and schedule the rollout of new process version. Procedures may also be imported/exported.

9 Monitoring, Measurement, and Management Information

TIBCO offers two products to track, report on, and analyze business processes, as well as interfaces for third party tools.

- TIBCO iProcess Analytics
- TIBCO iProcess Insight
Figure 7. The TIBCO iProcess Analytics

TIBCO iProcess Analytics (iPA) provides a sophisticated tool to analyze the effectiveness of entire business processes, based on historical analysis of audit data and case data (iPA can also act against simulation data). It is designed to allow management to establish and continuously measure Key Performance Indicators (KPIs) for ongoing process performance and improvement. Comparison of task/process execution time can be performed on an enterprise wide basis, and drilled down and filtered by any factor (process, task, group, user, data within the case, etc) and compared against enterprise, department, or individual KPIs.

The iPA front end is browser-based and presents designated users with a list of pre-defined Favorites reports. Users with the ability to define their own reports are also presented with a list of available KPIs and dimensions. Users simply drag and drop the required KPIs and/or dimensions and then select the chart type they wish to use. Management dashboards can also be created incorporating several views and delivered via the Web or PDF.

TIBCO iProcess Analytics can also import data from external systems, such as data warehouses, to provide even broader views with integrated employee, financial, or even supply chain information. KPIs and SLAs can be set up with defined ranges, values, and warning/alarm settings – KPIs falling outside alarm values can trigger exception reports via email.

The combination of the audit trail data, combined with comprehensive case data for each process instance, provides an enriched management reporting capability, supporting the achievement of organizational KPIs. It also supports users as they drill down and filter by any factor.

TIBCO recently launched its BAM offering for iProcess, and it is called iProcess Insight. This BAM offering leverages the event-driven architecture of the iProcess Engine, which published XML over JMS messages at key state changes in the process. The message frequency and granularity is configurable and those messages (or events) are then consumed, aggregated and ultimately displayed in the Insight event finder. Users have access to all the relevant KPIs in this event finder and also have the ability to
download from any case data to the exact case for action (e.g. suspect the case, reassign it, jump to a step, and much more).

10 Templates and Frameworks

TIBCO provides two vertical industry frameworks containing domain specific knowledge in the form of processes, rules, and pre-built reports. These frameworks utilize the iProcess Engine and the other components of the Suite.

- The TIBCO Claims Management Framework is targeted at the Insurance Industry. It enables the end-to-end design, automation, integration, management, and tracking of the claims process from the customer interface to the claims back-office.

- TIBCO Fulfillment Framework offers out-of-the-box definitions for the major processes required by a Telecoms Operator, linking the core administrative functions with the Business Support Systems (BSS) and Operational Support Systems (OSS).

11 Vendor

Staffware plc, which was acquired on the 7th June 2004 by TIBCO Software Inc. Staffware began researching process support in 1984, culminating in the release of the first working version of Staffware in 1987. TIBCO is the successor to a portion of a business founded in 1985, known as Teknekron Software. In 1997 TIBCO was established as a separate entity, and went public on NASDAQ (TIBX) in 1999. TIBCO products are licensed by approximately 2,100 companies worldwide in diverse industries such as telecommunications, retail, healthcare, manufacturing, energy, transportation, logistics, financial services, government, and insurance. TIBCO Software Inc. directly employees some 1,500 staff. The combined business has offices in over 23 countries.

12 Cost

The pricing model for iProcess is based around two parameters – users and server processors. Initial TIBCO iProcess projects are in the order of $250,000-300,000, with an average sale price of around $400,000. Standard support and maintenance includes major upgrades and is charged at 18%.
Ultimus BPM Suite

Version 7

Ultimus Inc.
15200 Weston Parkway, Suite 106, Cary, NC 27513
Tel: 919-678-0900 Fax: 919-678-0901
Web: www.ultimus.com Email: info@ultimus.com

1 Product Overview

The Ultimus BPM Suite provides a collaborative, programming-free, process-modeling, and development environment, along with flexible integration and workflow capabilities, powerful management tools, and easy to use web-based interfaces for process participants. It aims to deliver the shortest time to value available in the industry.

Ultimus first appeared in the mid-90s and has gone through several phases of redevelopment as new technological trends have swept the market. Today it sits on top of a Microsoft .NET foundation, leveraging open industry standards such as XML Schema and Web Services (WSDL, SOAP), MAPI, SMTP, LDAP, and ADSI).

Along with the expected graphical modeling environment for the processes, Ultimus leverages a sophisticated server-side spreadsheet metaphor that enables non-developers to handle application specific information, business rules, and routing assignments. The concept is used at the level of the process and of individual steps to give fine-grained control over variables, form layout, and field editing rules.

Ultimus continues to use this approach to address integration requirements. Tight integration with third party applications is achieved via the Ultimus Flobots that are trained to handle interactions with the external systems. Flobots are available for end-user oriented application such as Word, Excel, PDF, File, and E-Mail, as well as systems-oriented approaches such as Web Services, XML, Databases, and .NET. The Enterprise Integration Kit provides several alternative approaches to Flobots (see Integration Section), as well enabling developers to adapt the BPM Suite to tightly integrate with the overall IT architecture.

Ultimus recently introduced a feature known as Adaptive Discovery™, a new innovation that accelerates the deployment and adaptation of business processes. Instead of requiring the development of complete process maps and definitions, Adaptive Discovery only requires complete definition of the tasks, integration facilities, and data requirements. The more volatile work assignments, routing, and exception handling requirements can be added later. With Adaptive Discovery, process experts add this information to the process model on the fly, as needed by the circumstances of the case in hand. The process learns from these decisions and follows them automatically in the future when matching cases occur, without the need to develop replacement process models. In this way, processes are defined and enhanced the same way they evolve in business – in response to real world business decisions and requirements. For a wider discussion of this feature, see the section on Process Adaptability.

2 BPM Engine

The Ultimus BPM Server consists of a set of scalable components based on the Microsoft .NET architecture and enterprise databases to provide transactional integrity, security, scalability, redundancy, and dynamic load distribution. All key components are multi-threaded, leveraging an advanced stateless process execution model with all information required to track the state of a case persisted in an enterprise database (SQL Server or Oracle).
Since the Server is .NET-based (leveraging open technologies such as XML and Web Services), it can act as an underlying BPM platform for processes spanning multiple third-party enterprise applications. Along with the Flobots mentioned earlier, an Enterprise Integration Kit (EIK) and a robust set of APIs are provided for flexibility and ease of integration.

The Ultimus BPM Server is composed of the core Process Orchestration Engine and a separate Integration Engine component, which is responsible for managing connectivity to enterprise applications. It manages the execution of integration agents called Flobots that run on the BPM Server and Ultimus FloStations (Flobot Servers that share the same BPM Server but are geographically distributed for enhanced scalability). The first two components (Process Orchestration and Integration Engines) are not separable; they form the core of the BPM Server.

Ultimus can both produce and consume Web Services. On the production side, any process or subprocess can be exposed as a Web Service, allowing third party applications to invoke them. In addition, specific aspects of process execution are also exposed, allowing status to be queried, or permitting steps in the middle of processes to be completed via a Web Service. In terms of consumption, Ultimus can consume Web Services (using Flobots) as steps in the process, conditionally based on business rules (event conditions), or within dynamic forms.

2.1 Platforms


2.2 User Interface

Ultimus offers three browser-based clients – an ActiveX-based client interface, an ASP.NET-based thin client, as well as FloPorts that are Web Parts that run in portal environments. A range of different out-of-the-box interfaces is available to address the needs of most companies (as well as external process participants). Ultimus Reports provide a web-based module for producing and viewing a wide variety of reports that detail process efficiency information.
The standard Ultimus client is used with Internet Explorer and is embeddable as a view within Outlook. The thin client is ASP.NET-based, and Web Parts are also delivered to customize ASP controls in a portal or web page. Ultimus FloPorts for SharePoint 2003 are Web Parts optimized for use in SharePoint 2003. These Web Parts offer much of the functionality of the Ultimus Standard Client while maintaining a very small footprint. Custom interfaces can also be developed using the EIK.

Each of these interfaces provides Initiate, Inbox, Completed, Archive, and Custom views of a User’s tasks and those of his or her subordinates. In addition, Ultimus Clients can allow reassignment of tasks as well as tabular and graphical views of case status.

![Ultimus Thin Client](image)

**Figure 2. The Ultimus thin client delivers all relevant functionality within a standard web browser**

### 2.3 Scalability

Ultimus has been built from the ground up with scalability in mind and is based upon a Microsoft .NET foundation. The Ultimus BPM Suite is built using a highly scalable, multi-thread, component-based architecture that can potentially support thousands of users. Ultimus also leverages an advanced stateless process execution model. This means all the information required to track the state of business process is persisted to an enterprise database by the BPM Server components.

BPM Servers can be installed in parallel load-balancing configurations for added scalability. Each BPM Server requires both the orchestration and integration components. However, Ultimus supports the separation of all Flobots onto the separate FloStation Server. This can help separate some of the integration processing performed by Flobots off to another machine for enhanced scalability. FloStation can be distributed to various geographies if needed.

Ultimus’ architecture allows it to leverage out-of-the-box clustering capabilities provided in the Advanced and Datacenter Editions of the Windows Server 2000 and in all editions of 2003 for high availability and fail-over redundancy. With Windows clustering, if a server in a cluster goes down, another server in the cluster will automatically take the downed server’s place. Using these capabilities, it is possible to implement high-availability Ultimus BPM Server deployments in network load-balancing environments. Moreover, the Ultimus pricing model means that customers pay no additional fees to expand their cluster. (They can add as many boxes and CPUs as they need. See Cost.)

Since Ultimus is stateless and does not require *sticky sessions* (that are tied to particular components on a server), any load-balancing product can pass requests to multiple BPM Servers that are set up in parallel, redundant configurations. Further, the product does not depend on any particular load-balancing algorithm used by the load-balancing product. In addition, Ultimus servers can easily be added to parallel load-balanced configurations; all that you need to ensure is that the new Ultimus server is identified to the 3rd party load-balancing product.
3 Processing Modeling

The Ultimus BPM Suite provides two distinct modeling environments. The high-level Ultimus Process Designer is a stand-alone graphical process design application intended to allow business analysts and power business users to design, model, document, and optimize business processes without any IT involvement. Ultimus believes that if you can use Visio and understand the basics of processes, you should be able to use Process Designer.

The second application is BPM Studio, which is oriented towards the needs of BPM Teams. BPM Studio incorporates all of the design and modeling capabilities delivered in Process Designer. It includes both modeling and building modes, enabling processes to be developed from scratch or to be enhanced from designs built into Ultimus Process Designer.

BPM Studio is used to convert business processes into deployable solutions integrated with databases, electronic forms, business rules, other processes, and third party applications. It connects to one or more BPM Studio servers, which store information about processes in development in a shared repository. Combined with granular, component level security, BPM Studio allows many people to work on various parts of the same process simultaneously. Once a process is completed, it is published to a BPM Server through a right-click menu option. When processes are installed to a BPM Server, they are live and are instantly available to all authorized users. Studio can also import process models from Microsoft Visio, IDS Scheer, or Mega. Other tools can be readily supported, using an XML exchange format.

BPM Studio is designed to support collaborative process development by BPM teams. The target user for Studio is an IT analyst – a user who understands the IT infrastructure, the business needs, and the process and its fundamental flow and logic considerations. The bulk or, in many cases, all aspects of process development, can be done without any programming or scripting. When that is required, IT developers can either work in Studio to assist with more advanced efforts or use tools such as Visual Studio .NET to develop specialized software services that can be called from the Ultimus process via .NET or Web Services. Conversely, business users and analysts on the process team can use the BPM Studio interface to participate in appropriate aspects of the process implementation effort, such as reviewing form design.

3.1 Subprocesses

Ultimus can handle both embedded subprocesses and stand-alone subprocesses (subprocess as objects). Subprocesses generally remain separate from the main process and are instantiated, based on some variable condition or human decision. The system can dynamically determine if it will invoke the subprocess once or multiple times, based on design time settings interacting with variables associated with the case. Subprocesses may be called synchronously (triggered), in which case the parent waits for completion, or asynchronously (spawned), in which case the parent continues once the subprocess is instantiated. Ultimus offers a number of ways of defining and calling subprocesses.

- All Ultimus processes can be published as Web Services, and Web Services can be consumed and delivered by Ultimus processes. In this way, any process can be called as a subprocess in every instance, via conditional action or through human decision at any step in any process.
- Any Ultimus process can be hard-coded as a subprocess and as such can then only be called from within another process.
- Any process can be initiated via XML, email, or text command, and can, therefore, be launched as a subprocess by an automated Ultimus step at any point in any other process.

Business rules (known as event conditions) can reference process data in their definitions, enabling dynamic orchestration of different Web Services to be performed at runtime. Using the Spreadsheet
Capability of Ultimus, it is possible to dynamically populate an array that can then be used to drive association of different subprocedures for each element in the array.

### 3.2 Shared Data Space

The BPM Server Database contains all the information needed by Ultimus to control business process execution. The Process Orchestration Engine uses this information to decide what actions to take at the conclusion of each step in the process. All application-related information is maintained in External Databases and via third party applications.

This information is accessed via the Distributed Spreadsheet Model that provides a simple way to create variables, calculations, and dynamic forms without programming. A spreadsheet metaphor was chosen because of its familiarity to process analysts and most business-oriented computer users, along with its ability to perform a wide variety of calculations. The spreadsheet abstracts users away from needing to know the Ultimus data model and minimizes the need for specialized database development and complex queries. It is important to note that this does not involve installing or downloading a spreadsheet application to each user. Instead, all calculations are performed server-side, with the resulting information shared with the clients via forms.

The Distributed Spreadsheet Model consists of a **Main Spreadsheet** that provides a *super set* of all information related to the process. It collects and distributes information to all the steps in the process and performs common calculations. All global variables (used by all steps) are managed in the main spreadsheet. This is complemented by a **Local Spreadsheet** that exists at each step. Cells in the Local Spreadsheet may be linked to cells in the Main Spreadsheet and linked to fields in electronic forms for the step.

![Figure 3. The patented Distributed Spreadsheet Model provides the framework to develop sophisticated business processes without complex scripts or programs](image.png)

Beyond the data managed in the model, process information can be pulled from or pushed to databases and other applications through forms, event conditions, rules, or Flobot steps in the process.

### 3.3 Forms

In Ultimus, forms are the visual representation of process data at a step in the process (managed by the Local Spreadsheet and any databases behind that). This approach enables the use of different form technologies at different steps in the process, and it simplifies integration. Forms can also support attachment capabilities to link documents and files to a process instance.

Ultimus directly supports the form types of ASP.NET, HTML, PDF, InfoPath, and ActiveX. BPM Studio also includes capabilities for ActiveX-based and Thin (HTML) Forms design. These interfaces
allow for drag and drop creation of forms and graphical linking to process variables. It also allows for graphical linking of PDF and InfoPath forms to process variables.

3.4 Time

Every step can be assigned a completion time – either a constant, fixed value, or a relative value. For human steps, email notifications are sent to participants or their supervisors when tasks become late. Additionally, event conditions (business rules) can be defined when tasks go late to drive re-routing or other activities. For automated steps, this means that the server will make multiple attempts to complete the step. If after that time, the step is impossible to complete, the Server returns an error and email notification to the Administrator.

When Ultimus calls third party applications via a Web Service, provisions can be included to notify a human if that automated step does not complete within a certain time (or if it returns an error).

3.5 Process Optimization and Simulation

Simulation within Ultimus is designed to support the developer testing the efficacy of the process before deployment. Simulation is designed to provide a comprehensive testing capability that is identical to a real life situation. Within the Process Designer, the developer can create scenarios that use probabilistic modeling to follow various paths through the process model.

4 Business Rules

The Event Conditions Table in BPM Studio is used to specify sophisticated business rules. The BPM Engine interprets these conditions and, on the basis of these settings, dynamically computes the process path for the instance in hand. Effectively, Event Condition Tables allow designers to bypass the core logic of the process, based upon exceptions and the values of variables. By using Event Conditions, Ultimus attaches the evaluation of business rules to specific process events – a step being completed, going late, or being resubmitted, etc. This allows redirection of the flow without explicitly adding Rules Evaluation steps into the map.

The Adaptive Discovery approach builds on the event conditions concept. It uses the same approach of attaching rules to specific process events, but also supports friendlier rules constructs and expanded features. A key aspect of Adaptive Discovery is support for the development of business rules on the fly, as needed by the case in hand. A wider discussion of Adaptive Discovery is included the Process Adaptability section.

5 Integration

One component of the BPM Server is the Integration Engine. This component is responsible for managing connectivity to enterprise systems through support for open standards such as XML, Web Services, SMTP, MAPI, and .NET. It supports integration in several methods, but the key mechanisms are Flobots, Web Services, direct integration with stand-alone forms packages, and, for more complex integrations situations, the Enterprise Integration Kit (EIK). The range of Flobots is shown in Figure 1.

Flobots allow process developers to easily link in third party applications. Flobots turn popular applications – such as Excel, Word, or enterprise applications like PeopleSoft and SAP – into robots. Just as robots are used for their flexibility to perform many different tasks on a factory floor, Flobots enable these popular applications to perform specific process tasks. For example, it is possible to train desktop applications such as Excel to calculate a graph. In the case of Word, this means it can then automatically produce reports, documents, letters, forms, printouts, or faxes (executing macros, as required).
BPM Studio also provides a point-and-click interface to seamlessly link in third party electronic forms solutions such as PDF and InfoPath. At design time, developers graphically link process variables to controls on these third party form types.

When a process instance reaches the Flobot step, it passes data to the Flobot and invokes it. For relatively straightforward system-oriented integration, Flobots are provided for Databases, .NET, Web Services, and XML. The XML Flobot can link to variables with any XML schema, enabling information exchange with any XML-compliant application. The Database Flobot enables the process model to directly call any SQL Stored Procedures developed in the external database.

Ultimus also includes the capability to call Web Services and Managed Code directly from within a form. A control in a form can be configured to execute a Web Service or Managed Code when activated or triggered by an event condition. Such Web Services or Managed Code might invoke logic in third party enterprise applications such as SAP, or perform sophisticated computations on data. The EIK also includes a .NET Class Interface, enabling the development of custom user interface clients. Developers can also create their own Flobots, using the .NET Interface, and an XML schema provides a framework for communication between Ultimus and any third party applications.

6 Organizational Structure

Ultimus Administrator is a Microsoft Management Console (MMC) snap-in for managing process activity and server functions. Alongside that is Ultimus Org Chart, which provides a web-based, graphical representation of organizational structure that enables drag and drop realignment of resources. The Org Chart integrates tightly with LDAP, Active Directory, or other directory systems.

The Ultimus Org Chart is a web-based component of the Ultimus BPM Suite. It allows users to graphically reflect the organization chart of their companies, while leveraging their existing investment in directory technologies. The Org Chart can contain companies, divisions, departments, sections, job functions, and groups. The Ultimus Org Chart supports direct integration with Active Directory where users from Active Directory can simply be referenced in a read-only manner when building Org Chart Roles and Job Functions or in a bi-directional integration model where changes to the Ultimus Org Chart are immediately reflected in Active Directory, and vice versa. LDAP Directory Support is also included along a programmatic interface to link in other Directory Systems.

7 Process Adaptability

As mentioned already, Ultimus has introduced a new feature called Adaptive Discovery. This allows the business to focus on the core needs of the process and work out any exceptions and additional rules, as required, with the case in hand. This is a unique capability that no other vendor has offered. It negates the need to exhaustively develop process models prior to deployment.

As the process model is used, the Ultimus Adaptive Discovery technology detects when the BPM Server does not have the information about what should happen next in a process or who should do the next work step. An end-user has the ability to disown a task to Ultimus Director when they feel the task has been incorrectly routed to them. When either of these situations occurs, a message is sent to a process expert (or group of experts). The process expert then uses his knowledge of the business and the context of the current incident to create a rule that defines what happens next (an action), and why. This is done via the Ultimus Director that is designed specifically for process experts. Once the rule is defined, it is applied against the current case, causing the desired result (routing or other actions) to occur.

Now that the rule has been defined, future cases of this process will incorporate that rule to determine routing or task assignments. As the system is used more and more, the system learns all possible rules and routes.
The Ultimus Director also allows process experts to add rules and actions at any time, not just when the system is processing active incidents. Additionally, if changes are needed, the expert can make them at any time, actively managing the process and optimizing the flow whenever needed. However, the key point is that this feature allows firms to bypass the heavy burden of initial requirements definition. Firms can develop working systems far more quickly, safe in the knowledge that they can be modified later to handle exceptions.

8 Process Lifecycle

When the process development phase is complete, any authorized user can publish it to a live BPM Server (or test server). Once published, the process is immediately available to all users authorized to initiate that process. If the process is a revision of a currently deployed process, Ultimus prompts the developer to install a new version or upgrade the currently deployed version. If a new version is installed, all existing live incidents of the process will run to completion under the old design, while new incidents will run under the new design. If upgraded, all live incidents will be immediately upgraded to the new version of the process. At any time, authorized process developers can view a process’s design history and choose to revert to a previous version of the process.

9 Monitoring, Measurement, and Management Information

Process Monitoring and Analytics are provided in the Ultimus Administrator, the Ultimus Client/Thin Client, FloPorts, and Ultimus Reports. The Ultimus Administrator incorporates a powerful query builder, enabling users to zoom into the list of incidents that are in progress or completed. When an individual case is selected, the software displays a color-coded workflow map that shows the status. The application provides a range of facilities to interact with the results of the query, including search and replace; the editing of local and global variables; individual tasks that can be activated, aborted, completed, or reassigned; etc.

Figure 4. Ultimus Reports is used to generate and access a wide variety of reports to explore the cost and effectiveness of processes

Ultimus Reports is a comprehensive web-based report generation module, which allows business managers, analysts, and administrators to evaluate and improve the efficiency of their automated processes. Web-based reports can be designed, generated, and accessed securely from anywhere over the Internet. Tabular or graphical reports suitable for management review can be created or modified on the fly, using the Reports Wizard. Cost, time, and status metrics can be viewed from a user, step, department, queue, or process perspective. Ultimus also provides an open schema for reports data so third party reporting tools can be used, if desired.

Ultimus Reports provides a predefined report for
10 Templates and Frameworks

Ultimus does not provide any packaged templates or frameworks. It does publish a list of process profiles that highlight solutions in use at other customers.

11 Vendor

Ultimus is now one of the largest BPM vendors in the market. Headquartered in Cary, North Carolina, the company has business operations and sales offices throughout North America, Europe, Asia, South America, and the Middle East. Through these offices and a network of more than 100 partners in 61 countries, Ultimus can boast more than 1,400 distinct customers and over 60% growth for the last three years. Ultimus employs over 250 people; product development accounts for around 75 employees while client consulting supports a further 80.

Rather unusually, the product itself is available in 18 different languages (Arabic, Brazilian Portuguese, Simplified Chinese, Traditional Chinese, Dutch, English, French, German, Greek, Hebrew, Italian, Japanese, Korean, Polish, Portuguese, Romanian, Spanish, and Turkish).

12 Cost

Ultimus employs a value based licensing model:

- Servers are licensed on a step threshold approach, where the license is calculated based on a maximum number of process steps that a server can execute in a day. Levels start at 3,000 steps and move up from there. If the step limit is exceeded, several warnings are issued to provide time to upgrade. Under this model, CPUs or physical servers are not counted. Customers can deploy any way they want. It is the logical server capacity that is measured.

- Secondly, they license Active Clients – the number of unique users that participate in processes, beyond initiating them (there is no charge for anonymous users). In most organizations, this count is less than named users, but more than concurrent users, and reflects active involvement.

- Thirdly, Ultimus licenses concurrent users of BPM Studio for process implementation efforts.
Maintenance is 20%, annually. A pilot system can be deployed for under $25,000 dollars (software licensing). A typical system will be between $50,000 and $100,000 for software, depending on the factors described above.
## ACI Worldwide: WorkPoint, Version 3.4

<table>
<thead>
<tr>
<th>Overview</th>
<th>Both J2EE and native .NET Engines; highly adaptable (at runtime) and embeddable; sophisticated process semantics supporting looping, goal seeking and pre/post conditions; monitor capability on external events</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPM Engine</td>
<td>Both native .NET and pure J2EE runtime engines;</td>
</tr>
<tr>
<td>Platforms</td>
<td>Microsoft and Java; virtually any database (JDBC/ADO/OLEDB);</td>
</tr>
<tr>
<td>User Interface</td>
<td>XHTML Gateway; embeddable applets for external applications</td>
</tr>
<tr>
<td>Scalability</td>
<td>Components spread across cluster; leverage underlying container or framework (J2EE or Microsoft); distributed Monitors; stateless execution model</td>
</tr>
<tr>
<td>Processing Modeling</td>
<td>Nodes and Transitions; semantics support looping and goal-seeking; Pre' &amp; Post conditions</td>
</tr>
<tr>
<td>Subprocesses</td>
<td>Any process invoked as a sub-process at runtime; synchronous and asynchronous; dynamic binding</td>
</tr>
<tr>
<td>Shared Data Space</td>
<td>Both referenced from external applications and imported into contextual space</td>
</tr>
<tr>
<td>Forms</td>
<td>XHTML Gateway; alternatively XML tags for custom applications, forms builder auto generate and deploy to gateway</td>
</tr>
<tr>
<td>Time</td>
<td>Delays related to case and task; multi-level escalation conditions</td>
</tr>
<tr>
<td>Optimization &amp; Simulation</td>
<td>Development tools to test process capabilities</td>
</tr>
<tr>
<td>Business Rules</td>
<td>Sophisticated BRE embedded; leveraging structure of SDS</td>
</tr>
<tr>
<td>Integration</td>
<td>Server and GUI API; With 2 native versions of the run-time engine (&gt;NET and J2EE); virtually any Java interface; C and COM object APIs for integration with C#, J#, VC++, VB, ASP, .NET framework components, VB.Net, ASP.NET and Web Services</td>
</tr>
<tr>
<td>Organizational Structure</td>
<td>Direct integration of LDAP, Active Directory or a third party product (HR product or email systems); JAAS</td>
</tr>
<tr>
<td>Process Adaptability</td>
<td>Dynamic binding of processes as objects at runtime; capability to modify process for case at runtime (access controlled by role)</td>
</tr>
<tr>
<td>Process Lifecycle</td>
<td>Category filtering mechanism for all objects in repository; Archive Manager for export/import of processes &amp; related information</td>
</tr>
<tr>
<td>Monitoring &amp; Measurement</td>
<td>Designer tool for monitoring; Management Console for dashboard style monitoring of environment and workload</td>
</tr>
<tr>
<td>Templates &amp; Frameworks</td>
<td>ACI Automated Case Management System, available transfer of most BP modeling application frameworks and templates</td>
</tr>
<tr>
<td>Vendor</td>
<td>ACI Worldwide; 402 390-7600; <a href="http://www.aciworldwide.com">www.aciworldwide.com</a></td>
</tr>
<tr>
<td>Cost</td>
<td>Entry level pricing is US $20,000, scaling to over US $500,000; model based on client users (defined as automated or human users)</td>
</tr>
</tbody>
</table>
### Appian Corp: Appian Enterprise, Version 4.0

<table>
<thead>
<tr>
<th>Overview</th>
<th>Web-based, process-enabled workspace supporting collaborative projects amongst knowledge workers; rich security framework, designed to support managed change rather than rigidly enforce control; Process combined with support for Rules, IM, Discussion, Content &amp; Personalization. Considerable strength in Asian market at moment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPM Engine</td>
<td>Replicable engines at the back-end that communicate with the Java interface layer; Rules, Personalization, Content Management, Collaboration Engines</td>
</tr>
<tr>
<td>Platforms</td>
<td>Solaris, Linux &amp; Windows; Oracle, DB2, MySQL &amp; SQL Server; JBoss, WebSphere, WebLogic, &amp; Oracle Application Servers</td>
</tr>
<tr>
<td>User Interface</td>
<td>JSR-168 based portal environment; integrated security model</td>
</tr>
<tr>
<td>Scalability</td>
<td>Largest customer 1.5 million users and over 500,000 logins per day; load-balanced and fail-over support in back end; replicated engines</td>
</tr>
<tr>
<td>Processing Modeling</td>
<td>Web-based BPMN modeler; Smart Nodes; Expression Editor; Multiple instances of all nodes; Looping</td>
</tr>
<tr>
<td>Subprocesses</td>
<td>Independent subprocess objects; Chaining; synchronous and asynchronous calls</td>
</tr>
<tr>
<td>Shared Data Space</td>
<td>Sophisticated process workspace; arrays on all object types; including other Appian objects such as Groups, discussions, chat sessions, etc.</td>
</tr>
<tr>
<td>Forms</td>
<td>Integrated portlets; HTML, JSP, PDF and InfoPath</td>
</tr>
<tr>
<td>Time</td>
<td>Node &amp; process level; multi-level escalation</td>
</tr>
<tr>
<td>Simulation</td>
<td>Integrated Discrete Event Simulation environment</td>
</tr>
<tr>
<td>Business Rules</td>
<td>Embedded BRE; sophisticated Expression Editor</td>
</tr>
<tr>
<td>Integration</td>
<td>Smart Nodes; JCA Connectors/Adapters; Web Services;</td>
</tr>
<tr>
<td>Organizational Structure</td>
<td>LDAP/AD; sophisticated security model supports entire product</td>
</tr>
<tr>
<td>Process Adaptability</td>
<td>Re-assign tasks, edit model underpinning current process instance</td>
</tr>
<tr>
<td>Process Lifecycle</td>
<td>Version control; utilizing the product itself, one could develop a fully functioning lifecycle management tool that captured all related discussion, attached documents, release authorizations, etc.</td>
</tr>
<tr>
<td>Monitoring &amp; Measurement</td>
<td>Integrated Process Analyzer; personalized Dashboards</td>
</tr>
<tr>
<td>Templates &amp; Frameworks</td>
<td>Sample models in Government/Defense, Financial Services, Health Care, Insurance &amp; Retail</td>
</tr>
<tr>
<td>Vendor</td>
<td>Appian Corporate; (703) 442 8844; <a href="http://www.appiancorp.com">www.appiancorp.com</a></td>
</tr>
<tr>
<td>Cost</td>
<td>Named user pricing starts at $1K per user, entry level around $50K; typical cost $100K</td>
</tr>
</tbody>
</table>
### Ascentn Corporation: AgilePoint, Version 2.5

<table>
<thead>
<tr>
<th>Overview</th>
<th>Entire product engineered to leverage Microsoft products with tight integration of Visio, InfoPath, SharePoint, Office System OpenXML, Windows Workflow Foundation, .NET &amp; Visual Studio; aims to deliver 5-10x more cost effective solution than J2EE-based environments.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPM Engine</td>
<td>Highly scalable .NET Engine, .NET &amp; Web Services link together presentation layer, AgilePoint Server, &amp; data layer; Open API.</td>
</tr>
<tr>
<td>User Interface</td>
<td>Leverage Visio, InfoPath, SharePoint, Office solutions, etc.</td>
</tr>
<tr>
<td>Scalability</td>
<td>.NET &amp; IIS framework; ‘scale up’ through clustering and NLB support; ‘scale out’ through distributing selected AgilePart or process fragments to dedicated server.</td>
</tr>
<tr>
<td>Processing Modeling</td>
<td>Envision extends Visio; link automatically to InfoPath, ASP.NET, WinForm, Excel forms, etc.</td>
</tr>
<tr>
<td>Subprocesses</td>
<td>Stand-alone process objects invoked via Web Services or native API; any process could act as a nested subprocess of another.</td>
</tr>
<tr>
<td>Shared Data Space</td>
<td>Custom attributes; constructed in Envision, imported from InfoPath, or developed externally in Visual Studio.</td>
</tr>
<tr>
<td>Forms</td>
<td>InfoPath, Win Form, ASP.NET, Excel form.</td>
</tr>
<tr>
<td>Time</td>
<td>At task &amp; across entire process.</td>
</tr>
<tr>
<td>Optimization &amp; Simulation</td>
<td>Simulation tool exercises model looking for bottlenecks and cost allocation.</td>
</tr>
<tr>
<td>Business Rules</td>
<td>Conditional expressions or programmed in Visual Studio; Alternatively called from external rules engine such as BizTalk.</td>
</tr>
<tr>
<td>Integration</td>
<td>AgilePart mechanism enables reuse of existing IT assets; API for both Client &amp; Server applications; Web Services.</td>
</tr>
<tr>
<td>Organizational Structure</td>
<td>Use either internal structures or LDAP/AD.</td>
</tr>
<tr>
<td>Process Adaptability</td>
<td>Cases suspended, resumed, or cancelled; Tasks skipped, reassigned, User definable delegation rules; dynamic selection of subprocesses; dynamic update of process instances if required.</td>
</tr>
<tr>
<td>Process Lifecycle</td>
<td>Models deployed to multiple environments; Version control track lifecycle (created, released, checked-out, checked-in, &amp; retired).</td>
</tr>
<tr>
<td>Monitoring &amp; Measurement</td>
<td>Facilities for real-time tracking of cases; visual status monitor available to all users; management dashboard.</td>
</tr>
<tr>
<td>Templates &amp; Frameworks</td>
<td>Leveraging InfoPath and SharePoint; OEMs developing vertical solutions.</td>
</tr>
<tr>
<td>Vendor</td>
<td>Ascentn Corp; (650) 968-6789; <a href="http://www.ascentn.com">www.ascentn.com</a></td>
</tr>
<tr>
<td>Cost</td>
<td>Starter Edition for 20 state-less concurrent users under US $10,000.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overview</th>
<th>A Web-based integrated tool that implements a complete process lifecycle, BPEL &amp; Web Services-based orchestration. Includes a Business Rule Engine plug-in for building rule-based BPM, and a BPMN-based modeler. The BP engine is portal-centric, views can be analyzed by activity or task in real time.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPM Engine</td>
<td>SOA + EDA (Event Driven Architecture) based Engine</td>
</tr>
<tr>
<td>Platforms</td>
<td>All platforms - Solaris, Linux &amp; Windows; All Databases; All Application Servers - JBoss, WebSphere, WebLogic, Oracle Application Server</td>
</tr>
<tr>
<td>User Interface</td>
<td>Browser-based; JSR-168 portal environment</td>
</tr>
<tr>
<td>Scalability</td>
<td>10 million transactions per hour on a 4 processor systems</td>
</tr>
<tr>
<td>Processing Modeling</td>
<td>Web-based modeler with BPMN notation. Templates and support for task modeling. Generates BPEL from models.</td>
</tr>
<tr>
<td>Subprocesses</td>
<td>Subprocesses invoked synchronously &amp; asynchronously; imports individual subprocesses.</td>
</tr>
<tr>
<td>Shared Data Space</td>
<td>Graphically present information within WSDL (ex. partner, binding info, etc.), Variables (DB metadata etc.) &amp; Subprocesses</td>
</tr>
<tr>
<td>Forms</td>
<td>JSP, Servlet, Portlet based, XML Forms, InfoPath</td>
</tr>
<tr>
<td>Time</td>
<td>Have a separate scheduler for Timer Event in BPEL activities such as onAlarm, Wait etc. (Timer, Deploying, Deadline)</td>
</tr>
<tr>
<td>Simulation</td>
<td>Simulation available after modeling to optimize processes by identifying bottlenecks &amp; problems</td>
</tr>
<tr>
<td>Business Rules</td>
<td>Graphical Rule Editing in real time. User does not need to write rule code, Browser based familiarity &amp; handiness; BPMN style</td>
</tr>
<tr>
<td>Integration</td>
<td>Supports Web services, support WSIF which is more advanced than JCA; provide adaptors with separate API for the established legacy applications.</td>
</tr>
<tr>
<td>Organizational Structure</td>
<td>Re-use of LDAP based directory environments</td>
</tr>
<tr>
<td>Process Adaptability</td>
<td>Reuse and re-assign business processes &amp; tasks; Edit process in execution; Dynamic binding of processes as objects at runtime.</td>
</tr>
<tr>
<td>Process Lifecycle</td>
<td>Sophisticated version control throughout lifecycle by business process.</td>
</tr>
<tr>
<td>Monitoring &amp; Measurement</td>
<td>Process flow monitoring, audit trail by each activity, dashboard style interface. All these are available in real time.</td>
</tr>
<tr>
<td>Templates &amp; Frameworks</td>
<td>Product includes templates and business patterns.</td>
</tr>
<tr>
<td>Vendor</td>
<td>B2Binternet Inc.; +82 2 550-7209; <a href="http://www.xicobpm.com">www.xicobpm.com</a></td>
</tr>
<tr>
<td>Cost</td>
<td>XicoBPM costs between $40,000 and $70,000. A pilot system is available for under $25,000.</td>
</tr>
</tbody>
</table>
### Chordiant: Chordiant Enterprise Platform, Version 5.6

<table>
<thead>
<tr>
<th>Overview</th>
<th>Both powerful BPM Engine &amp; suite of process-enabled applications; underpinned by &amp; tightly integrated with extensible application-oriented object model (Common Application Framework Environment – CAFÉ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPM Engine</td>
<td>Services Oriented Architecture based on J2EE, leveraging Web Services functionality throughout</td>
</tr>
<tr>
<td>Platforms</td>
<td>IBM WebSphere, BEA WebLogic, Sun Solaris, Linux, IBM AIX, Microsoft Win2000, IBM DB2, &amp; Oracle</td>
</tr>
<tr>
<td>User Interface</td>
<td>Dynamic user interface rendered on the fly, taking on required capabilities as needed by process &amp; user role. All underpinned by CAFÉ framework. Vertical applications have custom user interfaces</td>
</tr>
<tr>
<td>Scalability</td>
<td>Benchmark up to 20,000 users + 6 million transactions per hour</td>
</tr>
<tr>
<td>Processing Modeling</td>
<td>Modeler provides wide range of options on semantics of processes built on Shared Data Space imported from Rose</td>
</tr>
<tr>
<td>Subprocesses</td>
<td>Embedded or standalone; Invoked synchronously &amp; asynchronously, either directly called or through Web Services</td>
</tr>
<tr>
<td>Shared Data Space</td>
<td>Imported from external modeling tool such as Rational Rose</td>
</tr>
<tr>
<td>Forms</td>
<td>CAFÉ provides reusable dynamic behaviors &amp; 3rd party tools</td>
</tr>
<tr>
<td>Time</td>
<td>Set absolute or relative time deadline for Tasks. System can be set to take specified actions, set alarms or move work to next user, etc.</td>
</tr>
<tr>
<td>Optimization &amp; Simulation</td>
<td>Core Engine used to drive pre-production simulation environment using what-if scenarios; works on actual process model</td>
</tr>
<tr>
<td>Business Rules</td>
<td>Separate Business Rules modeler leveraging underlying information architecture of the domain (Shared Data Space)</td>
</tr>
<tr>
<td>Integration</td>
<td>Uses JCA architecture underneath Business Services, which are called by Client Agent proxies, that are then reused by process descriptions</td>
</tr>
<tr>
<td>Organizational Structure</td>
<td>Import LDAP/AD structures, any third party application</td>
</tr>
<tr>
<td>Process Adaptability</td>
<td>Case Handling capability allows multiple processes against a case</td>
</tr>
<tr>
<td>Process Lifecycle</td>
<td>Version management &amp; applications controlled via CVS, ClearCase or equivalent.</td>
</tr>
<tr>
<td>Monitoring &amp; Measurement</td>
<td>Bundled BAM environment</td>
</tr>
<tr>
<td>Templates &amp; Frameworks</td>
<td>Selection of vertical &amp; horizontal applications focused around Retail Finance. CAFÉ user interface framework. Wide range of customer oriented Business Services reused by applications</td>
</tr>
<tr>
<td>Vendor</td>
<td>Chordiant Software; 408-517-6168; <a href="http://www.chordiant.com">www.chordiant.com</a></td>
</tr>
<tr>
<td>Cost</td>
<td>Typical installation in $500,000 range</td>
</tr>
</tbody>
</table>
### Clear Technology Inc: Tranzax, Version 4.0

| Overview | Fully integrated Case Handling environment with sophisticated support for data, events, procedures, and business rules. Entire environment is configured rather than resorting to programming |
| BPM Engine | J2EE Engine incorporating process engine, integrated business rules engine, Case Handler (state management of underlying data); administration console, etc. |
| Platforms | Windows, Linux, & UNIX; JBoss & WebSphere; DB2, SQL Server, & Oracle |
| User Interface | CaseAgent thin-client browser application dynamically generates user interface based on case related data and role (and process definition) |
| Scalability | Standard J2EE can run on single machine or across three clusters (process server, web server, and database) |
| Processing Modeling | Workbench for offline and connected development; configuration of various components of entire solution; includes graphical procedural modeling environment |
| Subprocesses | Sub-procedure step can invoke any other process; synchronous and asynchronous invocation; sophisticated interaction with rules, looping behavior, event-based triggers, etc. |
| Shared Data Space | Hierarchical structure of Cases, Documents, Sections, and Elements; Tightly manages all data states, local and remote; |
| Forms | Dynamic JSP-based forms generated at runtime based on configuration information |
| Time | Wait steps, related to data states and events; can apply a number of waiting strategies when invoking sub-procedures (again, related to data states and events) |
| Simulation | Native simulation data set feature allows configurations to run in a test environment |
| Business Rules | Integrated BRE; various types of Rule Sets & Result Sets combine to create refined control over entire environment |
| Integration | XML Services handle messaging, typically via Web Service format, using SOAP over HTTP, HTTPS, or MQ. |
| Organizational Structure | Uses either existing LDAP directory server or the default LDAP server shipped with the product |
| Process Adaptability | Case Handling environment, with multiple processes running against a case |
| Process Lifecycle | Components “promoted” through various “zones” from Configuration to Test/Training into Production |
| Monitoring & Measurement | Complete audit trail of every step performed showing the full business rule tree as executed with the actual data used |
| Templates & Frameworks | First Notice of Loss in P&C Insurance application |
| Vendor | Founded in 1998, has around 100 employees and 26 major projects completed or under development |
| Cost | Separate development and production licenses, entry level around $100K |
CommerceQuest: TRAXION Enterprise Business Process Management Suite  
Version 7.2.2

<table>
<thead>
<tr>
<th>Overview</th>
<th>Distinct collaboration &amp; integration environments (purchased separately or combined); Rich resource model &amp; broad range of integration options; USPs around CICS integration, range of modeling tools &amp; J2ME</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPM Engine</td>
<td>J2EE Engine; Process Repository (iGrafx or File based); 2 variants – Business Oriented BPM engine &amp; EAI oriented Integration Engine</td>
</tr>
<tr>
<td>User Interface</td>
<td>Browser-based</td>
</tr>
<tr>
<td>Scalability</td>
<td>App Server; distributed Work Queues; stateless Coordinator engine in EAI flavor, multiple Coordinators possible</td>
</tr>
<tr>
<td>Processing Modeling</td>
<td>Flow &amp; Resource Modelers; Alternative modeling tools from iGrafx &amp; MindManager; Future support for other BPA tools</td>
</tr>
<tr>
<td>Subprocesses</td>
<td>Process hierarchies, linked or embedded; invoked at runtime, synchronously or asynchronously</td>
</tr>
<tr>
<td>Shared Data Space</td>
<td>Import from external environment adding to XML structure</td>
</tr>
<tr>
<td>Forms</td>
<td>Any third party form that generates Java Servlet Pages (JSP)</td>
</tr>
<tr>
<td>Time</td>
<td>Due date &amp; deadlines; automatic alerts &amp; escalation; milestones</td>
</tr>
<tr>
<td>Optimization &amp; Simulation</td>
<td>Pre-Production simulation option optimize models before deployment, round-trip optimization</td>
</tr>
<tr>
<td>Business Rules</td>
<td>Integration of Corticon Rules engine, Resource Cube supports sophisticated routing rules</td>
</tr>
<tr>
<td>Integration</td>
<td>Adapters &amp; Message Queues; Introspection/componentization of 3rd party apps; Web Services; EAI oriented Integration Xcelerator wide range of options including high performance CICS extension</td>
</tr>
<tr>
<td>Organizational Structure</td>
<td>ResourceCube reflects overall structure of business and all resources; import facility from LDAP (soon to re-use functionality directly)</td>
</tr>
<tr>
<td>Process Adaptability</td>
<td>If needed, new versions can selectively over-write process model; suspend &amp; delegate task options; re-allocate resources</td>
</tr>
<tr>
<td>Process Lifecycle</td>
<td>Either file based or iGrafx Process Central; sophisticated check-in &amp; check-out; tracks dependencies; facilities to review, sign off changes</td>
</tr>
<tr>
<td>Monitoring &amp; Measurement</td>
<td>Integrated Process Monitor &amp; dashboards; monitors actual effort, duration &amp; cost of each task and overall project/process</td>
</tr>
<tr>
<td>Templates &amp; Frameworks</td>
<td>Wide range of Process Accelerators across Financial Services, Healthcare, HR, Retail, Insurance, Supply Chain &amp; Enterprise Mgt.</td>
</tr>
<tr>
<td>Vendor</td>
<td>CommerceQuest; 813-639-6300; <a href="http://www.commercequest.com">www.commercequest.com</a></td>
</tr>
<tr>
<td>Cost</td>
<td>Concurrent Process License model; Design, simulation &amp; test environment $75K for 5 users; Entry level execution around $45K; Integration Engine $75K upwards; Enterprise Licenses</td>
</tr>
</tbody>
</table>
### eg Solutions Limited: eg work manager

| **Overview** | Business Operations Management package that links business processes, IT & operations to the delivery of KPIs; based on sophisticated production management capabilities & superior management information |
| **BPM Engine** | Integrates with third party BPM engines, or a bundled engine is supplied where necessary |
| **Platforms** | NT & Windows Server 2003, SQL Server 2000 & SQL Server 7 |
| **User Interface** | ASP.NET for reporting & work allocation |
| **Scalability** | 6000+ users on a single 16-way Intel box |
| **Processing Modeling** | Typically inherited from third party BPM engine, otherwise modeled at the Task level & processes composed from that basis |
| **Subprocesses** | Nested subprocesses supported |
| **Shared Data Space** | Inherited from process engine |
| **Forms** | LOB application or 3rd party engine related |
| **Time** | Used at the task or case level to set benchmarks & SLAs; Service definition & work allocation cycles |
| **Optimization & Simulation** | Based on operational rules, builds a realistic picture of work to do & work in progress; Sophisticated planning capability around work resources required; calculate how much a team or organizational unit can handle; Separate forecasting module to assess impact of change |
| **Business Rules** | Operational rules related to standards for customer service, quality, resources (availability and skills) as well as time |
| **Integration** | Integration Services component talks to either MQ or Web Services |
| **Organizational Structure** | Re-use of LDAP or AD information, extended to cover skills & other organizational structures |
| **Process Adaptability** | Not concerned with process adaptability (inherited from BPM Engine) |
| **Process Lifecycle** | Entire methodology & product set oriented to support continuous optimization of organizational performance |
| **Monitoring & Measurement** | Sophisticated reports pre-defined for Managers and Team Leaders, Operational Intelligence component for dashboards & dice/slice OLAP based data |
| **Templates & Frameworks** | None applicable (in a sense the whole environment is a template for management of process related businesses) |
| **Vendor** | eg Solutions Ltd (UK); +44 (1785) 715772; [www.eguk.co.uk](http://www.eguk.co.uk) |
| **Cost** | Licensed users & implementation fees, firm guarantees results based on organizational assessment carried out beforehand |
### FileNet Corp.: FileNet Business Process Manager, Version 3.0

<table>
<thead>
<tr>
<th>Overview</th>
<th>Sophisticated Content &amp; Process Management tool set; Object Oriented event based model launches appropriate processes in response to changes in content state; Tightly integrated Analytics and Simulation environments</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPM Engine</td>
<td>J2EE Server with separate engines for Process &amp; Content</td>
</tr>
<tr>
<td>Platforms</td>
<td>SunOS, IBM AIX, HP UX &amp; Microsoft Windows Server; WebSphere, WebLogic, JBoss &amp; Tomcat; SQL Server &amp; Oracle</td>
</tr>
<tr>
<td>User Interface</td>
<td>My Workplace Portal (JSR 168), deployable to any browser</td>
</tr>
<tr>
<td>Scalability</td>
<td>6.32 million transactions per hour on an 8-processor system</td>
</tr>
<tr>
<td>Processing Modeling</td>
<td>Various node types, Component steps added to Palette</td>
</tr>
<tr>
<td>Subprocesses</td>
<td>Submaps called anywhere from within the process model; Web Services for dynamic binding of process fragments</td>
</tr>
<tr>
<td>Shared Data Space</td>
<td>Variables of virtually any kind including arrays; Sophisticated repository tightly integrated with process</td>
</tr>
<tr>
<td>Forms</td>
<td>Powerful eForms capability; plus any HTML, JSP or ASP form</td>
</tr>
<tr>
<td>Time</td>
<td>Milestones &amp; Checkpoints, multi-level escalation</td>
</tr>
<tr>
<td>Optimization &amp; Simulation</td>
<td>Bundled simulation capability based on actual process models &amp; process audit data; enabling round-trip optimization</td>
</tr>
<tr>
<td>Business Rules</td>
<td>Separate Rules Engine (ILOG) integrated</td>
</tr>
<tr>
<td>Integration</td>
<td>Integration Services to componentize 3rd party applications; Full range of Web Services functionality; range of APIs, .NET API due soon</td>
</tr>
<tr>
<td>Organizational Structure</td>
<td>Re-use LDAP/AD for both queues &amp; authentication</td>
</tr>
<tr>
<td>Process Adaptability</td>
<td>Case Handling add-on, dynamic binding of process fragments if needed</td>
</tr>
<tr>
<td>Process Lifecycle</td>
<td>Process objects could be managed through lifecycle capabilities of content repository</td>
</tr>
<tr>
<td>Monitoring &amp; Measurement</td>
<td>Broad array of management information available through OLAP cubes &amp; Excel reporting</td>
</tr>
<tr>
<td>Templates &amp; Frameworks</td>
<td>Wide range of offered via partner network – e.g., Case Management, Lending, Risk Management, Claims Management &amp; Compliance.</td>
</tr>
<tr>
<td>Vendor</td>
<td>FileNet Corporation, 3565 Harbor Blvd, Costa Mesa, CA 92626; 714-327-3400; <a href="http://www.filenet.com">www.filenet.com</a>; <a href="mailto:info@filenet.com">info@filenet.com</a></td>
</tr>
<tr>
<td>Cost</td>
<td>Entry level around $120K, typical sale $250K</td>
</tr>
</tbody>
</table>
Global 360, Inc.: Global 360 Enterprise BPM Suite, Version 9.4

| **Overview** | Comprehensive BPM Suite with industry leading optimization capabilities and a rich content / information management infrastructure. Ideal for both data and content driven processes. |
| **BPM Engine** | Multi-layered, enterprise class BPM Suite |
| **Platforms** | Core engine is Microsoft .NET based with rich SOA / multi-platform support for integration and end user environments. |
| **User Interface** | Native Application Designer capabilities enable rapid process application assembly, plus rich support for Microsoft Office , SharePoint and more. |
| **Scalability** | Highly scalable, both horizontally and vertically with large clients performing millions of transactions per day. |
| **Processing Modeling** | Integrated, multi-level process modeling environment supporting both technical and business analysts. |
| **Sub-Processes** | Fully supported and reusable |
| **Shared Data Space** | Rich content / information management infrastructure supporting content management, manipulation and long term storage / retrieval. |
| **Forms** | Native and Microsoft Office options available. |
| **Time** | Full business calendaring and international time zone / date support. |
| **Optimization & Simulation** | The industry leader in Simulation, Analytics and Performance Management. |
| **Business Rules** | Native and Corticon engines available, based on business need. Geared for the business professional. |
| **Integration** | Comprehensive SOA and legacy based integration capabilities. |
| **Organizational Structure** | Native model and/or integration with enterprise HR/ERP systems available. |
| **Process Adaptability** | Fully adaptable run time engine that enables business objectives to govern process behavior and process owners to make adaptations on the fly. |
| **Life-Cycle Management** | Full life cycle support with rich process repository. |
| **Monitoring & Measurement** | An industry leader in performance management and analytics enabling true end to end process optimization; features strong BPA capabilities. |
| **Templates & Frameworks** | Horizontal template library available coupled with deep domain expertise in financial services and insurance. |
| **Vendor** | Sizable / stable, profitable, rapidly growing. |
| **Cost** | Combination of system and user based pricing. |
### Graham Technology: GT Product Suite, Version 7.2

<table>
<thead>
<tr>
<th>Overview</th>
<th>Sophisticated object-oriented environment focusing on needs of high-end customer contact centers, with all user interaction driven by processes and rules; Integrates across multiple channels; Includes natural language, predictive customer self-service capabilities; Extensible underlying object model</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPM Engine</td>
<td>Unified model driven by two distinct engines – one for long running processes, the other for high-speed synchronous interaction</td>
</tr>
<tr>
<td>Platforms</td>
<td>Sun Solaris, IBM-AIX, HP-UX, Linux &amp; Windows 2000, XP &amp; 2003; Sun JES, IBM WebSphere, BEA WebLogic &amp; JBoss; User interface on multiple devices</td>
</tr>
<tr>
<td>User Interface</td>
<td>Rich forms and multi-channel capabilities driven by process models; 3rd party portal integration and high speed process browser to access server Process Portal</td>
</tr>
<tr>
<td>Scalability</td>
<td>Full J2EE compliance; Specialized in-memory process engine optimized for high volume real-time interactions; High-performance thin-client process browser</td>
</tr>
<tr>
<td>Processing Modeling</td>
<td>BPMN modeling tool for business processes; Interaction Dialogues also modeled as processes; Sophisticated support for related elements within a given user interaction</td>
</tr>
<tr>
<td>Subprocesses</td>
<td>Both synchronous and asynchronous subprocesses; re-synchronization via events for asynchronous subprocesses</td>
</tr>
<tr>
<td>Shared Data Space</td>
<td>Sophisticated object-oriented environment can represent virtually any business problem and is then available as part of the rich object model of the environment.</td>
</tr>
<tr>
<td>Forms</td>
<td>Interaction screens are driven by processes and rules; Employs a re-usable component model, enabling widespread re-use; multi-channel mechanisms</td>
</tr>
<tr>
<td>Time</td>
<td>Alerts and Escalations; Supports usual calculations based on process state and Timeouts; Unusual support for Lead-dependencies (e.g. SLA-1 week)</td>
</tr>
<tr>
<td>Simulation</td>
<td>Discrete Event Simulation capability integrated into Analysis &amp; Design Tool; Comparison of scenarios; Leverages same process model as execution environment; Allows what-if analysis based on actual process patterns and usage</td>
</tr>
<tr>
<td>Business Rules</td>
<td>Integrated rules environment used for decision purposes; Supports JSR 94 interface for third party Business Rules environments</td>
</tr>
<tr>
<td>Integration</td>
<td>Introspection of third-party applications at the API level; Sophisticated graphical tool enabling point and click data transformation and compound objects</td>
</tr>
<tr>
<td>Organizational Structure</td>
<td>Directly re-uses LDAP environment if available; utilized for Security purposes also</td>
</tr>
<tr>
<td>Process Adaptability</td>
<td>Enables sophisticated case handling environment; Predictive engine and natural language interfaces; mix and match design time prescription with flexibility</td>
</tr>
<tr>
<td>Process Lifecycle</td>
<td>Process models used to support development and deployment (for the BPM project); Hot Updates feature for real-time demonstration and adaptation</td>
</tr>
<tr>
<td>Monitoring &amp; Measurement</td>
<td>Portal-based dashboard providing a mixture of charts and KPI/SLA-based speedometers and traffic lights; all linked to extensible object model</td>
</tr>
<tr>
<td>Templates &amp; Frameworks</td>
<td>Contact Management, Case Management, Campaign Management, Correspondence Management, Catalogue Management &amp; Account-Order and Payment Management</td>
</tr>
<tr>
<td>Vendor</td>
<td>Established in Scotland in 1993; 220 employees and $27.5m Revenue in last fiscal year</td>
</tr>
<tr>
<td>Cost</td>
<td>Proof of concept as low as $30K; Sales range from $100,000 to $10 million.</td>
</tr>
</tbody>
</table>
# HandySoft Global Corporation: BizFlow, Version 10

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overview</strong></td>
<td>Highly configurable BizCove user interface; BPM project support; comprehensive EAI facilities; extended process semantics for routing; sophisticated mechanisms to control ad hoc working</td>
</tr>
<tr>
<td><strong>BPM Engine</strong></td>
<td>Two complementary Engines – the BizFlow Business Process Server and EAI focused BizFlow Transaction Process Server (sold separately)</td>
</tr>
<tr>
<td><strong>Platforms</strong></td>
<td>Windows Server 2003, 2000 and NT4, AIX, HP-UX, and SUN Solaris; Apache Tomcat, BEA WebLogic, IBM WebSphere, and Sun ONE; SQL Server 2000, Oracle 8i or 9i, or DB2 UDB 7.2</td>
</tr>
<tr>
<td><strong>User Interface</strong></td>
<td>BizCove portlets deliver great flexibility at the user level. Workitem Handler allows multiple applications to be delivered in a coherent fashion.</td>
</tr>
<tr>
<td><strong>Scalability</strong></td>
<td>60,000 transactions completed per hour with 10,000 simultaneous users; clustered and replicated servers</td>
</tr>
<tr>
<td><strong>Processing Modeling</strong></td>
<td>BizFlow Process Studio (general user) and BizFlow Integration Studio (IT developer); collaborative project development and deployment environment; Visio and MS Project integration</td>
</tr>
<tr>
<td><strong>Subprocesses</strong></td>
<td>Any process potentially called as a subprocess; called synchronously or asynchronously; SOAP &amp; WF-XML (potentially use Web Services for same thing)</td>
</tr>
<tr>
<td><strong>Shared Data Space</strong></td>
<td>Wide variety of variable types, including several types of arrays; private/public settings to control sharing between parent &amp; subprocesses; Custom Attributes for grouping cases (allowing later monitoring); EDMS support</td>
</tr>
<tr>
<td><strong>Forms</strong></td>
<td>Integrated Forms environment; support for third party forms (web forms in HTML, JSP, and applets as well as Adobe Forms, MS Word, and Excel)</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>Lead and Lag alerts (and dependencies); Alerts &amp; Escalation; Time Calculation</td>
</tr>
<tr>
<td><strong>Simulation</strong></td>
<td>Integrated simulation tool; export from BizFlow process models; Resource attributes reloaded from supplemental data</td>
</tr>
<tr>
<td><strong>Business Rules</strong></td>
<td>Point &amp; click development of constraint rules; integration with ILOG &amp; Corticon if needed; Pre &amp; Post conditions on activities</td>
</tr>
<tr>
<td><strong>Integration</strong></td>
<td>Sophisticated EAI style integration environment; choreographs business transactions; variety of adapters for most classes of application; message queue facilities; API set</td>
</tr>
<tr>
<td><strong>Organizational Structure</strong></td>
<td>LDAP import; synchronizes with multiple LDAP Directories simultaneously; multi-dimensional hierarchies</td>
</tr>
<tr>
<td><strong>Process Adaptability</strong></td>
<td>Change to running cases if needed; change propagation; case handling; sophisticated ad hoc capabilities with extensions</td>
</tr>
<tr>
<td><strong>Process Lifecycle</strong></td>
<td>Project support; publisher role; Check In-Check Out models; change propagation</td>
</tr>
<tr>
<td><strong>Monitoring &amp; Measurement</strong></td>
<td>Graphical Process Monitoring; aggregation of variables across cases; BizCoves provide variety of reporting styles and mechanisms.</td>
</tr>
<tr>
<td><strong>Templates &amp; Frameworks</strong></td>
<td>SOXA &amp; Accounts Payable Accelerators; wide variety of process templates for Government, Insurance/Financial Services, Commercial Finance and HR</td>
</tr>
<tr>
<td><strong>Vendor</strong></td>
<td>Korean publicly quoted parent; US based BPM oriented company; 100+ employees</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>Enterprise License model; average software cost $150K; 100 users $85K (150K including the BizFlow Integration Server); Evaluation license at $25K</td>
</tr>
</tbody>
</table>
# IBM : IBM WebSphere BPM Suite

<table>
<thead>
<tr>
<th><strong>Product Overview</strong></th>
<th>IBM offers a number of different products that can be used together or separately for BPM, including WebSphere Business (WB) Modeler, WebSphere Integration Developer, Process Server, and WebSphere Business Monitor.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BPM Engine</strong></td>
<td>IBM WebSphere Process Server supports multiple BPM engines and provides support for process integration through both BPEL and a workflow engine. WebSphere Process Server Foundation is based on IBM's WebSphere application server and J2EE and Eclipse.</td>
</tr>
<tr>
<td><strong>Platforms</strong></td>
<td>Most IBM WebSphere BPM products run on Java and J2EE. They run on Windows, Unix, Linux, and all major databases. Process Server will be released in second half 2006 on Zseries.</td>
</tr>
<tr>
<td><strong>User Interface</strong></td>
<td>Developer interfaces are based on Eclipse. User interfaces are browser based and utilize WebSphere Portal.</td>
</tr>
<tr>
<td><strong>Scalability</strong></td>
<td>IBM’s largest customers routinely deploy in complex enterprises.</td>
</tr>
<tr>
<td><strong>Processing Modeling</strong></td>
<td>Web-based BPMN modeler; Smart Nodes; Expression Editor; Multiple instances of all nodes; Looping</td>
</tr>
<tr>
<td><strong>Sub-Processes</strong></td>
<td>Independent sub-process objects; Chaining; synchronous and asynchronous calls</td>
</tr>
<tr>
<td><strong>Shared Data Space</strong></td>
<td>Sophisticated process workspace; arrays on all object types; including other WB Modeler objects such as Groups, discussions, chat sessions, etc.</td>
</tr>
<tr>
<td><strong>Forms</strong></td>
<td>Integrated portlets; HTML, JSP, PDF and InfoPath</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>Node &amp; process level; multi-level escalation</td>
</tr>
<tr>
<td><strong>Process Optimization &amp; Simulation</strong></td>
<td>Integrated Discrete Event Simulation environment</td>
</tr>
<tr>
<td><strong>Business Rules</strong></td>
<td>Rules supported by WB Modeler and WB Server, with the bulk of rules creation taking place in WID. Other vendors provide Rule-Based engines that can be integrated with WB Modeler or WB Server. IBM partners with ILOG for business rules.</td>
</tr>
<tr>
<td><strong>Integration</strong></td>
<td>Smart Nodes; JCA Connectors/Adapters; Web Services;</td>
</tr>
<tr>
<td><strong>Organizational Structure</strong></td>
<td>LDAP/AD; sophisticated security model supports entire product;</td>
</tr>
<tr>
<td><strong>Process Adaptability</strong></td>
<td>Re-assign tasks, edit model underpinning current process instance</td>
</tr>
<tr>
<td><strong>Process Life-Cycle</strong></td>
<td>Version control; utilizing the product itself, one could develop a fully functioning life-cycle management tool that captured all related discussion, attached documents, release authorizations, etc.</td>
</tr>
<tr>
<td><strong>Monitoring &amp; Measurement</strong></td>
<td>IBM offers a very sophisticated monitoring package based on WB Monitor, IBM’s Data Warehouse, analytics and BI, Tivoli, and its BPM Workplace dashboard.</td>
</tr>
<tr>
<td><strong>Templates &amp; Frameworks</strong></td>
<td>IBM provides a number of frameworks. IBM Global Services packages IBM BPM products with various industry specific templates and frameworks.</td>
</tr>
<tr>
<td><strong>Vendor</strong></td>
<td>IBM is a leader in hardware, software and consulting. It has 330,000 employees and earned US $91.1 billion in 2005. It has plants, research labs, and offices throughout the world.</td>
</tr>
</tbody>
</table>
### M1 Global Solutions Inc. : Business Convergence Suite, Version 2.2

<table>
<thead>
<tr>
<th>Overview</th>
<th>Execution engine integrates firms various channels, orchestrating processes across voice (call-center), web, email, chat, Web Services (in addition to people &amp; systems); BPMN modeler; sophisticated skills-based routing components; Focused on managed services &amp; outsource markets</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPM Engine</td>
<td>J2EE Server with plug-in Interaction Managers that allow the engine to drive customer interaction</td>
</tr>
<tr>
<td>Platforms</td>
<td>Linux, Windows; WebSphere or JBoss; Oracle or DB2</td>
</tr>
<tr>
<td>User Interface</td>
<td>Jetspeed-based Portal environment</td>
</tr>
<tr>
<td>Scalability</td>
<td>J2EE based container; work distribution algorithms ensure resources not overloaded</td>
</tr>
<tr>
<td>Processing Modeling</td>
<td>BPMN modeling environment based on Eclipse IDE</td>
</tr>
<tr>
<td>Subprocesses</td>
<td>Both Embedded and Independent; Spawned &amp; Triggered, Process Chaining</td>
</tr>
<tr>
<td>Shared Data Space</td>
<td>XML based; arrays; graphical mapping tool</td>
</tr>
<tr>
<td>Forms</td>
<td>JSF-based Web forms generated within the tool</td>
</tr>
<tr>
<td>Time</td>
<td>Timer Event type in BPMN – inline Intermediate event (between tasks) or Boundary event (relating to processes or subprocesses)</td>
</tr>
<tr>
<td>Optimization &amp; Simulation</td>
<td>Simulation tool scheduled for inclusion in next major release</td>
</tr>
<tr>
<td>Business Rules</td>
<td>Embedded within Gateway constructs of process models</td>
</tr>
<tr>
<td>Integration</td>
<td>All supported through Web Services – both inwards and outwards; Includes Web Service interface for process query</td>
</tr>
<tr>
<td>Organizational Structure</td>
<td>Teams, User skills, User Cost all considered by skills-based routing algorithms</td>
</tr>
<tr>
<td>Process Adaptability</td>
<td>Re-assign tasks, dynamic binding of subprocesses</td>
</tr>
<tr>
<td>Process Lifecycle</td>
<td>Managed deployment through development, testing &amp; production environments</td>
</tr>
<tr>
<td>Monitoring &amp; Measurement</td>
<td>Maintains records of all interactions &amp; process steps; monitoring all current instances; potential support for sophisticated audit or CRM</td>
</tr>
<tr>
<td>Templates &amp; Frameworks</td>
<td>Multi-Channel Interaction Management</td>
</tr>
<tr>
<td>Vendor</td>
<td>M1 Global; 404-419-7000; <a href="http://www.m1global.com">www.m1global.com</a></td>
</tr>
<tr>
<td>Cost</td>
<td>On Demand model - $8,500 per month (100 users, Web only; hosted); $25,00 per month (100 users; all channels including VoIP to the customer site; hosted); figures change depending on options and numbers of users</td>
</tr>
<tr>
<td><strong>Overview</strong></td>
<td>BPEL-based solution combining both automated tasks and human interaction capabilities for SOA. Native support for J2EE and Web Service standards such as BPEL, XML, XSLT, XPATH, JMS, WSIF &amp; JCA; Domains used to logically partition business problem (for different classes of customers, service, etc.)</td>
</tr>
<tr>
<td><strong>BPM Engine</strong></td>
<td>Core BPEL engine with discrete services that enable human interaction and wider SOA support; Provides a “dehydration” capability to store state information.</td>
</tr>
<tr>
<td><strong>Platforms</strong></td>
<td>Solaris, Linux, Windows with HP UX and IBM AIX currently in pre-release; Oracle Application Server, JBoss, WebLogic &amp; WebSphere; Oracle, DB2, Sybase, SQL Server, Oracle Lite</td>
</tr>
<tr>
<td><strong>User Interface</strong></td>
<td>Oracle Portal or web based user Worklist,</td>
</tr>
<tr>
<td><strong>Scalability</strong></td>
<td>J2EE environment leveraging capabilities of the application server; dehydration of long running instances frees up server resources; options to run entirely in memory for high performance</td>
</tr>
<tr>
<td><strong>Processing Modeling</strong></td>
<td>BPEL Designer plug-in for JDeveloper and Eclipse; Wizards used extensively to combine process patterns; broad support from third party modeling vendors</td>
</tr>
<tr>
<td><strong>Subprocesses</strong></td>
<td>Called as BPEL sub-processes; looping behavior and in-line scopes</td>
</tr>
<tr>
<td><strong>Shared Data Space</strong></td>
<td>XSD Browser, visual mapping transformation tool (XSLT-based)</td>
</tr>
<tr>
<td><strong>Forms</strong></td>
<td>Automatic generation of default HTML/JSP and JSF; InfoPath &amp; Acrobat also supported</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>OnAlarm allows developers to specify rich functionality around fixed date-time, elapsed time or expressions based on process variables</td>
</tr>
<tr>
<td><strong>Simulation</strong></td>
<td>Third party vendor support for process simulation and optimization (expect Oracle capability in this area soon); Validation mechanisms on process models</td>
</tr>
<tr>
<td><strong>Business Rules</strong></td>
<td>XPath based Expression Builder for relatively simple process constraints; fully blow BRE bundled with Oracle Application; third party vendors also supported</td>
</tr>
<tr>
<td><strong>Integration</strong></td>
<td>Broad range of data transformation, connectivity, notification and messaging capabilities; extensive adapter support through JCA; embed Java; tightly integrated with Oracle Data Hub and Oracle Integration B2B</td>
</tr>
<tr>
<td><strong>Organizational Structure</strong></td>
<td>Oracle Internet Directory, LDAP and Active Directory support</td>
</tr>
<tr>
<td><strong>Process Adaptability</strong></td>
<td>Multiple versions of the processes can coexist at runtime, otherwise limited to suspend and resume</td>
</tr>
<tr>
<td><strong>Process Lifecycle</strong></td>
<td>Domain concept can be used to separate development from testing and production; wide variety of third party version control systems supported</td>
</tr>
<tr>
<td><strong>Monitoring &amp; Measurement</strong></td>
<td>Operational monitoring and process management using the BPEL Console and the bundled Analytics capabilities. Business level monitoring of metrics and KPIs using Oracle BAM</td>
</tr>
<tr>
<td><strong>Templates &amp; Frameworks</strong></td>
<td>Demos and tutorials contain wide range of re-usable patterns. In the future, Oracle applications will form the basis of moldable business frameworks</td>
</tr>
<tr>
<td><strong>Vendor</strong></td>
<td>Founded in 1979; 50,000 employees; Revenues of over $10B fiscal year 2004</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>$40,000 per processor (user licensing also available); $10,000 add-on to Oracle 10g Application Server</td>
</tr>
</tbody>
</table>
### Pegasystems Inc.: Pegasystems SmartBPM Suite, Version 4.2

<table>
<thead>
<tr>
<th>Overview</th>
<th>Unified Business Rules Engine &amp; Process Engine, J2EE based; multi-dimensional Context Management dynamically assembles rules &amp; processes at runtime; forward &amp; backward chaining of rules</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPM Engine</td>
<td>Multiple Engines running concurrently on multiple operating systems (including Microsoft &amp; J2EE), all sharing the same rule base &amp; work database</td>
</tr>
<tr>
<td>Platforms</td>
<td>Windows, Solaris, Linux, AIX, z/OS; JDBC compliant database such as DB2, Oracle, or SQL Server</td>
</tr>
<tr>
<td>User Interface</td>
<td>Dynamically generated Portlet JSR 168; HTML gadgets embed process &amp; rule functionality (act as rule harnesses to functionality)</td>
</tr>
<tr>
<td>Scalability</td>
<td>Up to 10,000 concurrent users; 70m rule invocations per hour</td>
</tr>
<tr>
<td>Processing Modeling</td>
<td>Visio based modeling environment tightly integrated into rule system; Processes &amp; rules developed side-by-side</td>
</tr>
<tr>
<td>Subprocesses</td>
<td>Embedded &amp; Independent; synchronous &amp; asynchronous; chaining; Process is a specialized set of business rules &amp; subprocesses dynamically selected &amp; bound at runtime</td>
</tr>
<tr>
<td>Shared Data Space</td>
<td>Context Management provides semantic structuring across 6 dimensions.</td>
</tr>
<tr>
<td>Forms</td>
<td>HTML, 3rd party or PDF; Portlets</td>
</tr>
<tr>
<td>Time</td>
<td>Goal, Deadline &amp; Late states combined with multiple levels of escalation; context for dynamic binding of processes &amp; rules</td>
</tr>
<tr>
<td>Optimization &amp; Simulation</td>
<td>Includes a bundled discrete event simulation tool used to test assumptions</td>
</tr>
<tr>
<td>Business Rules</td>
<td>Includes a bundled discrete event simulation tool; test assumptions</td>
</tr>
<tr>
<td>Integration</td>
<td>Rules based wizards support introspection &amp; adapters/ connectors to &amp; from third party applications</td>
</tr>
<tr>
<td>Organizational Structure</td>
<td>Leverages existing LDAP based directory environments; skills &amp; skill levels used in routing rules</td>
</tr>
<tr>
<td>Process Adaptability</td>
<td>Ability to modify processes &amp; rule sets on the fly as needed; Case handling templates; authorized users re-route</td>
</tr>
<tr>
<td>Process Lifecycle</td>
<td>Validation of rules &amp; processes as created; Process Rules Explorer &amp; unit testing functionality</td>
</tr>
<tr>
<td>Monitoring &amp; Measurement</td>
<td>Process Analyzer tool visually represents work latency, delayed tasks, workload capacity, etc. Variety of OLAP cubes &amp; reports</td>
</tr>
<tr>
<td>Templates &amp; Frameworks</td>
<td>Pre-developed templates for financial services &amp; health insurance industries</td>
</tr>
<tr>
<td>Vendor</td>
<td>Pegasystems, Inc.; 617-374-9600; <a href="http://www.pega.com">www.pega.com</a></td>
</tr>
<tr>
<td>Cost</td>
<td>Usage model based on rule invocations; licensing of SmartBPM Suite starts at $100,000; Optional modules for simulation &amp; analysis</td>
</tr>
</tbody>
</table>
### Singularity: Singularity Process Platform, Version 3.0

<table>
<thead>
<tr>
<th>Overview</th>
<th>Microsoft-oriented BPM Suite – deploys on .NET; Service-Oriented Architecture (all components are callable as services); Native Web Services support</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPM Engine</td>
<td>.NET-based set of modular components – potentially supporting multiple engines distributed across multiple nodes; Event-driven execution</td>
</tr>
<tr>
<td>Platforms</td>
<td>Windows 2003 &amp; 2000 Server; Win2K &amp; XP Modeling Tool; Oracle &amp; SQL Server; Windows Active Directory &amp; LDAP</td>
</tr>
<tr>
<td>User Interface</td>
<td>Browser-based work queue and dashboard; Microsoft Sharepoint Web Parts portal</td>
</tr>
<tr>
<td>Scalability</td>
<td>Leverages the .NET container for transaction support, scalability, clustering, &amp; failover capabilities; Stateless, multi-threaded engine</td>
</tr>
<tr>
<td>Processing Modeling</td>
<td>Collaborative graphical process modeling environment; Built-in support for complex routing; Visio integration</td>
</tr>
<tr>
<td>Subprocesses</td>
<td>Supports embedded subprocesses &amp; independent process objects, invoked either synchronously or asynchronously; Process Library for re-use; Chaining</td>
</tr>
<tr>
<td>Shared Data Space</td>
<td>Local process &amp; global variables; Supports arrays; Categories; native WSDL support</td>
</tr>
<tr>
<td>Forms</td>
<td>Integrated Forms generator; HTML &amp; Portlet support, Sharepoint Web Parts; XML forms; Custom forms supported via web-services and APIs, third party forms</td>
</tr>
<tr>
<td>Time</td>
<td>Duration, due-date, etc., at node &amp; process level; Runtime monitoring of time elapsed per activity and process; Administrative job scheduling and business calendar; Overdue alerts and escalation (triggering new processes if need be)</td>
</tr>
<tr>
<td>Simulation</td>
<td>Self-Optimization facility – dynamic reconfiguration, triggering alternate processes, dynamic reallocation of resources to meet performance levels; Integrated process simulator; simulate using live, historical or test data; Export to Excel</td>
</tr>
<tr>
<td>Business Rules</td>
<td>Built-in decision support; sophisticated routing resolution; escalation processes at using exceptions and event triggers; integration to third party rules engines</td>
</tr>
<tr>
<td>Integration</td>
<td>Integration through Web Services, .NET, and COM+; rich API set; Integrates directly to SharePoint, BizTalk, Live Communication Server, Visio, Office, etc</td>
</tr>
<tr>
<td>Organizational Structure</td>
<td>Import Active Directory, LDAP v3 directories; Reflect human and system resources and multiple hierarchies; skill based and security-based routing</td>
</tr>
<tr>
<td>Process Adaptability</td>
<td>Runtime process adaptability, including dynamic changes to priorities, due dates, resource routing and actual structure of the process, as well as dynamic invocation of processes; multiple versions of processes can run simultaneously</td>
</tr>
<tr>
<td>Process Lifecycle</td>
<td>Shared process library; Process release triggers “Release approval” process; Pilot versioning; Documentation generation facility; Audit support</td>
</tr>
<tr>
<td>Monitoring &amp; Measurement</td>
<td>Monitor component provides user-configurable BAM facility; displays real-time and historical performance data; Event manager monitors and collects data, triggers events causing runtime engine to invoke escalation processes, etc</td>
</tr>
<tr>
<td>Templates &amp; Frameworks</td>
<td>Financial Services trading application; generic process maps for Telco and Government</td>
</tr>
<tr>
<td>Vendor</td>
<td>Singularity (212) 203 9360; <a href="http://www.profit-thru-process.com">www.profit-thru-process.com</a></td>
</tr>
<tr>
<td>Cost</td>
<td>Entry-level systems from $15k, typical initial projects $100k</td>
</tr>
</tbody>
</table>
## TIBCO Software Inc.: TIBCO iProcess Suite, Version 10.5

<table>
<thead>
<tr>
<th>Overview</th>
<th>Highly scalable engine; dynamic binding of procedural fragments at runtime; goal seeking processes; enabling flexible process architectures; Case Prediction facility; broad range of integration options;</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPM Engine</td>
<td>N-tier architecture, message queuing, dynamic linking process fragments at runtime, server distributed across several machines</td>
</tr>
<tr>
<td>Platforms</td>
<td>OS environments HP-UX, AIX, Solaris, Linux, Windows 2000/2003; Databases: Oracle, SQL Server &amp; DB2</td>
</tr>
<tr>
<td>User Interface</td>
<td>Browser-based Work Queue &amp; Procedure Manager; iProcess Forms facility as well as any third party forms packages</td>
</tr>
<tr>
<td>Scalability</td>
<td>Multiple server installations; single logical server distributed across multiple physical servers; Multi-threaded front-end</td>
</tr>
<tr>
<td>Processing Modeling</td>
<td>Business Studio avoids coding, using graphical functionality to cover all aspects: Data Design, Step Design, Integration &amp; Forms</td>
</tr>
<tr>
<td>Subprocesses</td>
<td>Dynamic binding of process fragments at runtime; both synchronously &amp; asynchronously; goal seeking possible</td>
</tr>
<tr>
<td>Shared Data Space</td>
<td>Arrays; XML import with XSLT tools for translation; ARIS import and support for custom import/export</td>
</tr>
<tr>
<td>Forms</td>
<td>iProcess Forms, 3rd Party forms applications</td>
</tr>
<tr>
<td>Time</td>
<td>Deadlines based on task or via variables; Multiple time zones</td>
</tr>
<tr>
<td>Optimization &amp; Simulation</td>
<td>Case Prediction facility; Uses actual process model; leverages Analytics functionality for optimization</td>
</tr>
<tr>
<td>Business Rules</td>
<td>OEM relationship with Corticon to provide a BRE. Tightly embedded within framework applications. Also support for integration with other 3rd party rules engines.</td>
</tr>
<tr>
<td>Integration</td>
<td>Broad range of options; wide range of Adapters and Plug-Ins, developer framework for plug-ins; Full API &amp; server-side object model; Integrated with TIBCO BusinessWorks</td>
</tr>
<tr>
<td>Organizational Structure</td>
<td>Shared Work Queues used to represent organization; import facilities from LDAP and other Directory Servers</td>
</tr>
<tr>
<td>Process Adaptability</td>
<td>Dynamic binding of process fragments at runtime; authorized users move the work onto selected steps bypass</td>
</tr>
<tr>
<td>Process Lifecycle</td>
<td>5-phase lifecycle supported by sophisticated repository with integrated version control</td>
</tr>
<tr>
<td>Monitoring &amp; Measurement</td>
<td>TIBCO iProcess Analytics, and iProcess Insight (BAM)</td>
</tr>
<tr>
<td>Templates &amp; Frameworks</td>
<td>Insurance Claims Management &amp; Telco Fulfillment Frameworks</td>
</tr>
<tr>
<td>Vendor</td>
<td>TIBCO Software Inc.; (650) 846-5637; <a href="http://www.tibco.com">www.tibco.com</a></td>
</tr>
<tr>
<td>Cost</td>
<td>Initial TIBCO projects are in the order of $250k-300k with an average sale price of around $400k</td>
</tr>
</tbody>
</table>
### Ultimus Inc.: Ultimus BPM Suite, Version 7

<table>
<thead>
<tr>
<th>Overview</th>
<th>Designed for non-developers; Microsoft based; Web Services &amp; Flobots for integration; Adaptive Discovery; Spreadsheet metaphor</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPM Engine</td>
<td>.NET based Server, wide range of clients (thin &amp; thick).</td>
</tr>
<tr>
<td>Platforms</td>
<td>Windows Server 2000 &amp; 2003, Modeling on XP &amp; Win2K</td>
</tr>
<tr>
<td>User Interface</td>
<td>Thin &amp; Rich clients, user interface embeddable into Outlook, custom clients also possible through direct integration</td>
</tr>
<tr>
<td>Scalability</td>
<td>Stateless, multi-threaded server, leveraging Windows clustering &amp; load-balancing systems</td>
</tr>
<tr>
<td>Processing Modeling</td>
<td>Stand-alone Process Designer &amp; collaborative BPM Studio tools</td>
</tr>
<tr>
<td>Subprocesses</td>
<td>Spawned &amp; Triggered, Arrays for dynamic subprocess. Invoked via Web Service, XML, email, or text</td>
</tr>
<tr>
<td>Shared Data Space</td>
<td>Powerful spreadsheet model for variables</td>
</tr>
<tr>
<td>Forms</td>
<td>ASP.NET, HTML, PDF, InfoPath, &amp; ActiveX</td>
</tr>
<tr>
<td>Time</td>
<td>Either a constant, fixed value or a relative value. Automatic escalation</td>
</tr>
<tr>
<td>Optimization &amp; Simulation</td>
<td>Developer create scenarios that use probabilistic modeling to follow various paths through the process model</td>
</tr>
<tr>
<td>Business Rules</td>
<td>Event conditions table, Adaptive Discovery mechanism</td>
</tr>
<tr>
<td>Integration</td>
<td>Flobots (for Acrobat, ASCII, Database, E-Mail, Excel, File, .NET, Web Services, Word, BizTalk and XML), Form level Web Services, .NET embedded, plus full API capability</td>
</tr>
<tr>
<td>Organizational Structure</td>
<td>Org Chart tightly integrated with both Active Directory and LDAP, plus integration kit for any 3rd Party Directory</td>
</tr>
<tr>
<td>Process Adaptability</td>
<td>Adaptive Discovery provides unique capability to vary process as required at runtime, building up comprehensive model over time</td>
</tr>
<tr>
<td>Process Lifecycle</td>
<td>Separate modeling and development environments, version control over models deployed</td>
</tr>
<tr>
<td>Monitoring &amp; Measurement</td>
<td>Wide range of Reports available (also available in separate web-based client)</td>
</tr>
<tr>
<td>Templates &amp; Frameworks</td>
<td>None</td>
</tr>
<tr>
<td>Vendor</td>
<td>Ultimus Inc.; 919-678-0900; <a href="http://www.ultimus.com">www.ultimus.com</a></td>
</tr>
<tr>
<td>Cost</td>
<td>Pilot system under $25K for software, typically software cost between $50,000 and $100,000.</td>
</tr>
</tbody>
</table>
Derek Miers is a well known independent industry analyst and technology strategist, who has published a great many white papers and product assessments. Over the years, he has reviewed literally hundreds of business process related products (from modeling to BPM Suites). His consulting has encompassed hundreds of training courses (on business and process modeling techniques), detailed technology selection assessments for BPM support, and project risk assessment studies. Other engagements have involved the provision of strategic advice – from facilitating board level conversations around BPM initiatives, to helping clients develop new business models and marketing strategies. Clients have included many of the world's largest and most well-known financial services companies (banks, building societies and insurers), pharmaceutical companies, telecoms providers, commercial businesses, product vendors and governmental organizations.

His current research focuses on the effect of the Internet on process innovation and the development of process architectures for adaptable, agile enterprises.

He is the only independent Board Member of BPMI.org.

Derek lives in London, England and can be reached at miers@enix.co.uk

Paul Harmon is the Executive Editor and Founder of the Business Process Trends website.

Paul is a noted consultant, author, and analyst concerned with applying new technologies to real-world business problems. Paul's most recent book is Business Process Change: A Manager's Guide to Improving, Redesigning, and Automating Processes (Morgan Kaufmann, 2003). He has written a wide variety of articles that have been published on BPTrends in the past two years.

Paul has worked on major process redesign projects with Bank of America, Wells Fargo, Security Pacific, Prudential, and Citibank, among others. He is a widely respected keynote speaker and has developed and delivered workshops and seminars on a wide variety of topics to conferences and major corporations through out the world.

Paul lives in San Francisco and can be reached at pharmon@bptrends.com
Curt Hall

Curt Hall is a well-known industry analyst, consultant, and newsletter editor. Curt's expertise includes business process management, business intelligence, data warehousing, business performance management, data mining, business rules engines, knowledge management and other analytic technologies. He also focuses on the commercial applications of intelligent software including rule-based systems, intelligent agents, and speech recognition.

In addition to working as an analyst for BPTrends, Curt is a senior consultant with Cutter Consortium's Business Intelligence Advisory service, where he serves as editor of the weekly Business Intelligence Advisor e-newsletter. He is also co-author (with Paul Harmon) of Intelligent Software Systems Development: An IS Manager's Guide (John Wiley & Sons) and a contributing author to James Martin and James Odell's Object-Oriented Methods: Pragmatic Considerations (Prentice Hall). Curt’s work has appeared in numerous technical journals and IT publications. His study on the corporate use of data warehouses and the issues associated with data warehousing projects has resulted in the in-depth report Corporate Use of Data Warehousing & Enterprise Analytic Technologies.

Curt lives in Berkeley, California and can be reached at curt@curt-hall.com