



Strategic White Paper

Ontology-Based Business Process Management

The Vision Statement

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Jenz & Partner was founded in 1985. Dieter E. Jenz serves as the company's president. The company provides a range of industry analyst, business and technical consulting, and educational services. It is widely known for its contributions to distributed applications, object-oriented development, and relational database technology. For additional information, Jenz & Partner's Website URL is www.jenzundpartner.de.

Jenz & Partner has developed a business process management ontology, which is available for download under a "free software"-like license and can also be made available to clients in the context of consulting engagements. Jenz & Partner provides training in ontology definition and in software development process optimization in general.

The Protégé-2000 ontology and knowledge base editor has been used for the definition of the Jenz & Partner business process management ontology. Protégé-2000 was developed by Stanford Medical Informatics at the Stanford University School of Medicine with support from various agencies.

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Executive Summary

For many years, business and IT have lived side by side, but still do not understand each other well. Much has been said about better alignment of IT with business, but actual results have been unsatisfactory in most organizations. Still, business and IT seem to speak in different tongues.

Serious efforts have been made to improve productivity and quality in both fields. In IT, new methodologies have been introduced over time, and design and development tools have much more functions than ever before. Yet, IT is still unable to keep pace with the rapidly changing business requirements.

Now, more than ever, there is a growing awareness that traditional roles need to be reconsidered. In the first generation, IT was assigned the task to implement business processes, which generally resulted in burying business process flow logic in application logic. The advent of Workflow Management Systems (WfMS), a. k. a Business Process Management Systems (BPMS) several years ago marked the beginning of the second generation. While business process flow logic now resides in the BPMS, IT is still responsible for business process design and deployment. Due to their affinity to traditional programming languages, workflow definition languages are generally difficult to learn and use for business analysts.

Clearly, there is a need for improvement. Business experts should be able to define and maintain business processes in some language that they easily understand. As a result, the language divide will be gone. The third generation will be marked by ontology-based business process management. Business experts will be able to define business processes in a knowledge base, which is based on an ontology. The knowledge base will serve as the common source for the generation of business process definitions in the specific process flow languages of the respective target Business Process Management Systems.

Not surprisingly, leading analyst firms, such as Gartner and Forrester, characterize ontology engineering as a core knowledge modeling activity that will have a profound impact on a wide range of enterprise applications and knowledge integration in the next few years. Ontology tools and techniques will offer the unified semantics needed to support business process management as well as dynamic application integration at the enterprise level.

This White Paper outlines the vision of third generation ontology-based business process management and explains why this approach helps to shrink time-to-market cycles of business processes, increase productivity and reduce costs.

Where Are We Today?

A combination of first and second generation business process management can be found in many organizations today. While 60-70% of a typical IT budget goes towards IT operations, the remaining 30-40% is used for managing business process change, which to a large extent means application development and maintenance. Focusing on application development and maintenance, some 70% of the budget goes towards maintenance. While there is awareness of such imbalance, permanent time pressures and resource constraints seem to prevent organizations from finding the means to solve the problem from the ground up.

Much has been done on the IT side to increase efficiency in the software development area. Various new design methods have emerged over the past decades and Integrated Development Environment (IDE) suites have significantly added functionality. The Model-Driven Architecture (MDA) approach, propagated by the Object Management Group (OMG), supports the generation of software from models. Despite these manifold efforts, however, little attention has been devoted to semantics over the past years. For example, it has taken several years for the now popular Unified Modeling Language (UML) to mature to a point where the semantics of modeling elements is clearly specified.

Although productivity and quality have increased in most IT departments over the past years, complaints from the business side have not subsided. It still takes too much time to implement new business processes or change existing business processes. IT seems not to be able to keep pace with the rapid speed of business change these days. Limited IT resources often result in delays, which may even compromise an organization's competitiveness. Not surprisingly, today, IT is often considered more as a part of the problem rather than as a solution.

Clearly, the potential of first and second generation business process management approaches is limited. Only a next generation approach can eliminate the semantic gap between business and IT, and can yield better productivity and quality.

Quo Vadis? or Where Are We Heading?

Not surprisingly, software vendors have always viewed business process management and integration issues from their angle, thinking of it primarily being a technical issue. Attempts to bridge the gap between business and IT have been initiated from the IT side at large. As a result, software vendors and software industry consortia have not done enough to enable business experts to describe business semantics. For example, business rules are of high importance to business experts, yet relatively little has been accomplished in the IT domain to give business experts the means to define business rules in a language they understand. The Object Management Group has started a Working Group only in 2003 to develop a business rule language specification.

A highly automated manufacturer would have a process, which enables engineers to design parts using some CAD/CAM software. The design can be used to produce a prototype product without human intervention, provided that the machinery can interpret the design. In a similar fashion, a business analyst should be able to design business processes, which are deployable in some business process management system. However, this requires business semantics to be equally understood by business and IT.

Object-oriented design and development techniques have started to emerge in the early 1990ies and are now predominant in IT. Object-oriented frameworks, encompassing architecture and design, have been commonly accepted as building blocks for application systems, effectively employing the concept of design reuse. No IT organization would design an application system from scratch these days.

Based on rich semantics, object-oriented principles will be applied in the business domain also. Business frameworks will emerge in the form of ontologies¹, allowing organizations to build on one or more ontologies and confine themselves to defining organization-specific specializations. Hence, principles of object-oriented design will see their introduction into the business domain.

As a practical result, time and resources needed for starting a new organization will be dramatically reduced, since a new organization could obtain a “business starter kit”, which would contain all standard business processes. The new organization would only need to care about defining the specifics that sets it apart from the competition. Of course, an existing organization would benefit as well as it ventures to explore new business areas or reorganizes existing business processes.

¹ An ontology defines the terms and concepts (meaning) used to describe and represent an area of knowledge, as well as relations among them. In a sense, it can be viewed as a problem-oriented information model.

The Vision

The need for better alignment of IT with business has been articulated uncountable times. Lessons from experience seem to indicate that the only way to fulfill this need is to equip business experts with the means to express business knowledge in a “language” they are able to understand, and which can also be spoken by IT experts.

Such kind of “business language” needs syntax, and semantics of concepts and relationships among them must be clearly defined. That is what an ontology provides. To be able to make business knowledge persistent, there must be some kind of repository. A repository is represented by a knowledge base.

An ontology can be loosely compared to a relational database schema, which is the organization or structure for a database. A relational database does not contain any user data after a database schema has been defined. Likewise, an ontology contains no user data. When we instantiate an ontology, that is when information is entered and stored, we actually create a knowledge base. Like a populated relational database, a knowledge base contains structure and data. However, unlike in the database field, where we would talk about “empty” or “populated” databases, we use two different terms to distinguish between the “empty” (ontology) and “populated” (knowledge base) states. Lately, with the advent of the Web Ontology Language (OWL), the distinction between “ontology” and “knowledge base” is given up and the term “ontology” is now used to mean both. In this White Paper, however, we keep up the distinction between “ontology” and “knowledge base”.

The Ontology

Third generation business process management is different in that it provides an integrated view on business processes. It empowers the business expert to define business processes and business rules. While the role of the business expert gains prominence, implementation-oriented aspects must not be neglected. The business oriented view has a counter piece in the form of the technical view (IT view), and both must be on an equal footing.

The business view can be segmented into three layers:

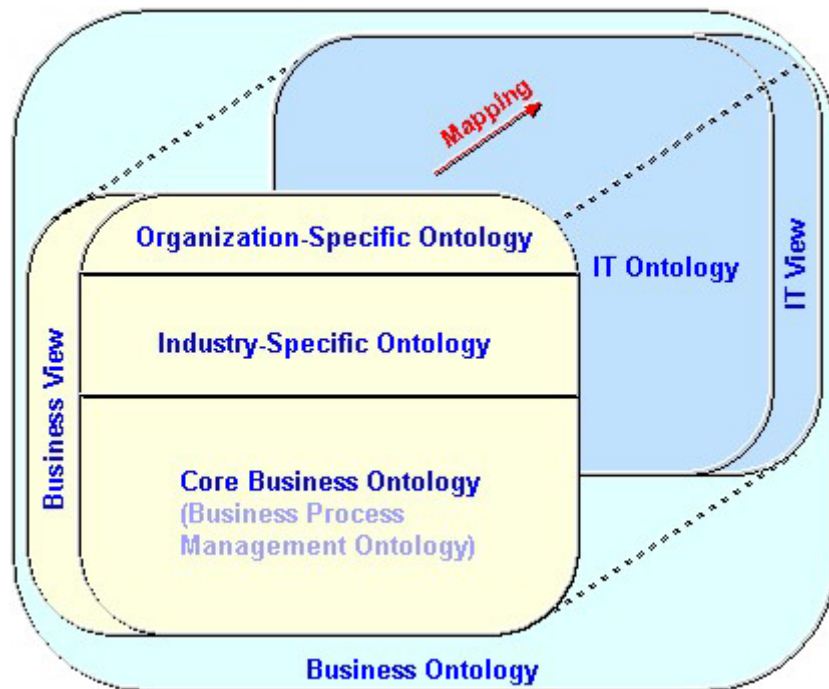
- Core business ontology layer;
- Industry-specific ontology layer;
- Organization-specific ontology layer.

The IT view is not segmented into layers and is completely organization-specific.

The segmentation into views and layers does not mean that an organization has to cope with multiple ontologies, which require permanent synchronization. It rather represents a logical separation of concern. Business experts would see the result of an ontology merge, which means that in their perception there is just one coherent ontology.

At the technical level, ontologies can be nested. As a consequence, an organization would be able to acquire ontology “components” from various sources. For example, an organization would choose to use the Business Process Management Ontology (BPMO) as nucleus to represent the core business ontology layer. The organization might want to acquire the industry-specific ontology layer from some industry body and develop the organization-specific ontology layer in-house.

The resulting business ontology represents a three-dimensional model.

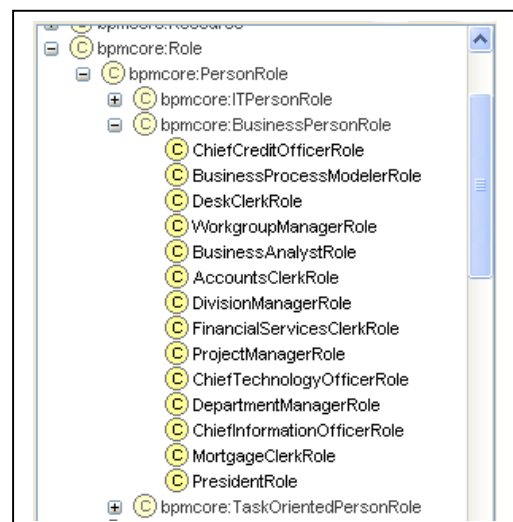


In line with practical experience, the expectation is that the core business ontology layer and the industry-specific ontology layer together cover more than 80% of an organization's business. In highly regulated industries, such as banking, insurance, and aviation, coverage may exceed the 90-95% mark.

The IT Ontology represents the translation of business knowledge into a "technical" representation.

Each ontology represents a single domain of responsibility, meaning that each ontology may have a different owner. The owner of a higher-level ontology does not have the right to alter an included lower-level ontology. However, a higher-level ontology may extend an included ontology, as is shown in the figure to the right.

While the core business ontology layer defines the "Business Person Role" concept, the organization-specific ontology layer extends this concept by defining roles that are specific to that particular organization. Of course, as with object-oriented systems, sub classes inherit properties from their respective super classes.



Conceptually, the layered approach has much in common with object-oriented frameworks. The core business ontology layer would represent the base framework. However, unlike object-oriented frameworks, ontology layers are business frameworks, meaning that no coding in some object-oriented programming language is involved. Each ontology is purely declarative, representing architecture and design, but not code.

The Business View

As mentioned above, the business view represents the aggregate of ontology “components”, each of which represents a layer.

Core Business Ontology Layer

The core business process management ontology is applicable in all industries and organizations around the globe. It defines basic concepts that can be found and are needed in every organization regardless of industry, such as “Resource”, “Organization Unit”, “Role”, “Business Process”, and “Business Rule”.

Viewed from a different angle, the ontology provides a business vocabulary. The terms represent concepts, which can be related to each other. Based on this information model, business experts will be able to describe private and public (a. k. a. collaborative) business processes in a semantically rich fashion.

Industry-Specific Business Ontology Layer

Every industry has a set of industry-specific concepts which supplement the basic industry-neutral concepts. For example, business documents are typically industry-specific. An invoice business document in the steel industry is quite different from an invoice business document in the food retail industry.

Industry bodies or consulting firms are primary candidates for the creation of industry-specific ontologies.

Organization-Specific Business Ontology Layer

An organization may wish to define specific concepts that sets it apart from other organizations in their industry. Although the Core Business Ontology Layer and the Industry-Specific Business Ontology Layer do not leave much to be defined, an organization is at liberty to define whatever is deemed necessary.

The IT View

The IT ontology comprises business objects, which are representations of business entities. While business experts are used to describing real-world concepts in the form of business entities, software engineers have a different world view. They use object-oriented analysis and design methods to create object-oriented models, which represent some “system-oriented” view in that object models are optimized for system performance.

A mapping needs to be provided to the business view. A business entity may be represented by multiple business objects and vice versa.

It is possible to export an IT view ontology for subsequent import into an object-oriented design tool, which can visualize the object model in the form of a UML class diagram. An organization may also choose to import an existing object model into the IT ontology

The Knowledge Base

The knowledge base rests on the aggregated business ontology, which represents a coherent information model that lets business experts express business knowledge both close to

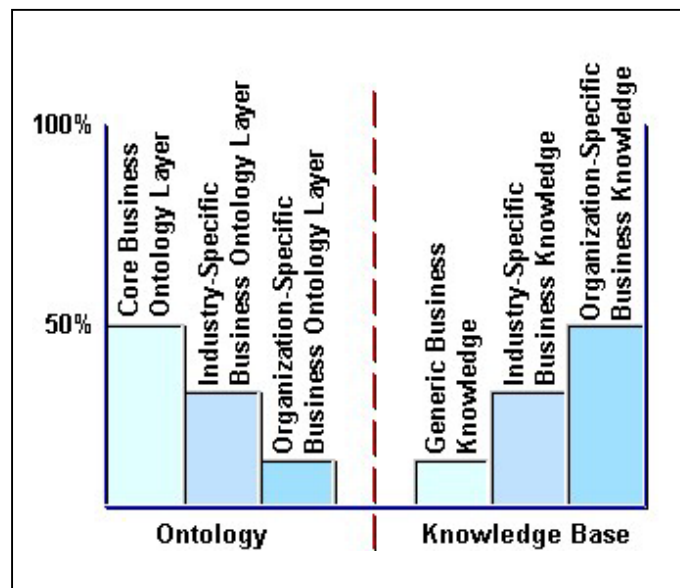
natural language and in a machine-interpretable fashion. It also enables IT experts to express “technical” knowledge and provide a mapping of concepts between business and IT.

Industry bodies and consulting firms would provide definitions for frequently used business processes, which are typical for their respective industry. As such, an organization would be provided with an out-of-the-box solution, which would enable the organization to generate deployable and executable business process definitions needed to run its core business operations.

Of course, an organization would need to go beyond core business operations to differentiate itself from the competition. Hence, business experts would change business process definitions, define additional business processes, and define business rules specific to the organization.

A pre-loaded knowledge base would not only come with some business process definitions, but would also contain various standard code lists from various sources, such as ISO and industry bodies.

While the Core Business Ontology Layer typically makes up some 50% of the business view, proportions are totally different in the knowledge base. Generic business knowledge would typically amount to some 10-15% of an organization’s business knowledge. Organization-specific business knowledge would command the biggest share. Hence, an organization has sufficient means to differentiate itself from the competition.



The corporate knowledge base also implements the IT view. It is possible to generate software design and development artifacts from definitions in the knowledge base. While this approach has much in common with the Model-Driven Architecture (MDA) approach, it excels MDA in terms of semantic precision.

Based on mappings established between the business view and the IT view, the knowledge base can also control data synchronization between application systems. For example, it is not uncommon for a large organization to operate more than 10 different ordering systems. Due to the multitude of application systems in use, the same type of information is typically held in multiple data stores, which require continuous synchronization. The knowledge base makes it possible to perform semantic data synchronization.

Who Benefits?

The “two world” syndrome is typical for most organizations today. There is the “business world” with its plethora of procedures, and there is the “IT world” with its multitude of application systems, that implement some of these procedures. Today, in general, still less than 20% of an organization’s procedures are supported by IT systems.

Both business and IT benefit from ontology-based business process management. The knowledge base can be the single source for the generation of a wide variety of artifacts, ranging from organization manuals to application source code. The rift between business and IT can be eliminated, thanks to the “semantic bridge”, that an ontology represents.

Ontology-based business process management will play a significant role in “computerizing” currently paper-based business processes. The generation approach will dramatically reduce time-to-market.

There are two basic scenarios, which complement each other, and help (re)synchronize business and IT.

The Reconciliation Scenario

For most organizations, ontology-based business process management represents a reconciliation approach. Not uncommonly, IT application systems, i.e. the “real world”, and organization manuals are out of sync with each other. In this scenario, an organization would import existing (implemented) business process definitions into the knowledge base.

For example, after the definition of the “Process Electronic Private Mortgage Loan Application” business process has been imported into the knowledge base, the business analyst would check whether there is already a definition of that particular business process in the knowledge base. If so, some business analyst has previously defined the process to represent the way it should be performed. The business analyst’s task would then be to compare and reconcile the two conflicting versions. When that has been accomplished, the business process is ready for redeployment in the business process management system. However, changes to existing application systems may become necessary.

The Clean Slate Scenario

In the less common case, that is when an organization has no BPMS in place, business analysts would define all business processes in the knowledge base. Generators can then produce business process definitions that can be deployed in the respective BPMS. In addition, application skeletons can be generated, which is completely in line with the increasingly popular “Model-Driven Architecture” (MDA) approach, propagated by the Object Management Group (OMG).

The clean slate scenario is also applicable for business processes that are not supported by an organization’s IT systems. The knowledge base would serve as the authoritative source for artifact generation.

Conclusion

Organizations are looking for means to keep track with an ever faster changing business environment. To gain an edge over the competition, organizations must find ways to change business processes faster. In most organizations, this involves changes at two levels, the business level and the IT level.

Ontology-based business process management is a rather novel approach. It puts the business expert into the driver's seat, which sets it apart from first and second generation business process management approaches, which leave business process definition to IT experts.

Thanks to the layered approach, organizations will be able to quickly get up to speed. Industry bodies or consulting firms will hopefully provide industry-specific out-of-the-box knowledge bases as "starter kits". Of course, organizations are still in the position to keep a competitive edge by extending the ontology to meet their specific needs, and by optimizing "standard" business process definitions. Hence, third generation business process management will enable user organizations to significantly increase productivity and shrink time-to-market cycles of business processes. Clearly, ontology-based business process management is a catalyst for economic growth.

Further Reading

To learn more about ontology-based business process management, you can access the Jenz & Partner Web site for our latest white papers and tutorials.

http://www.bpiresearch.com/Resources/RE_OntBPM/re_ontbpm.htm

http://www.bpiresearch.com/Resources/RE_SWPr/re_swpr.htm

The Business Process Management Ontology (BPMO) is available for free download at

http://www.bpiresearch.com/Resources/RE_OSSOnt/re_ossont.htm