Table 1 provides an overview of the Corticon Business Rules Management (BRM) platform and its main modules and functionality. Corticon’s approach to business rule modeling and execution differs in a number of ways from the more traditional (RETE-based) BRM products in which developers literally write rules using some form of rule-based language.

Corticon allows users to create rule sets in a completely declarative fashion using spreadsheet-like models. Using Corticon, organizations can model and manage their business policies, guidelines and operational decisions through an interface very similar to Excel.

Corticon features a “design-time” rules analysis functionality that mathematically verifies the reliability of the rules as a part of the modeling process. By applying patent-pending technology known as Predicate Logic Matrix, this design-time conflict-checking feature helps to ensure that modeled rules will deliver their intended result—providing a logically complete and unambiguous decision for every possible outcome. In effect, Corticon business models can be verified for conflicts and other logical errors with a click of the mouse, and then tested against business cases, without writing code.

Verified and tested, rule sets form an executable decision service. Each decision service conforms to a “service contract”, which fully describes the inputs and outputs of the service. Corticon generates compiled, optimized executable decision services (in the form of optimized Java byte code), which are deployed as Web Services or Java Services, enabling standards-based integration to automate decision points across corporate processes and applications.

Corticon decision services are optimized to execute reliably and exceptionally fast on the server. Runtime performance is fast because what is being executed has been optimized and compiled at design time. Decision services also take advantage of the application server’s scalability features.

Finally, Corticon is heavily focused on meeting decision automation needs (as opposed to traditional decision support applications), where fast design and reliable and fast execution are essential. Example Corticon applications include Sarbanes-Oxley and Basel II compliance initiatives, loan pricing and selection in banking, claims adjudication in insurance, complex service pricing in telecommunications, and supplier selection in manufacturing.

<p>| Corticon Business Rules Modeling Studio | Complete and comprehensive modeling, analysis and test environment ready “out-of-the-box”. Features intuitive spreadsheet-style business rules modeling and maintenance environment—based on an extended decision table format; support both developers and (non-technical) business users. Users can capture and model their organization’s best practices, policies and procedures without programming (i.e., coding). Models are fully executable, and can be incorporated into existing applications as Web Services or Java Services. Applies sophisticated analysis and mathematical techniques to identify (and assist users) in resolving logical integrity |</p>
<table>
<thead>
<tr>
<th>Table 1. Overview of Corticon BRM, Key Modules and Functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Corticon Business Rules Server</strong></td>
</tr>
<tr>
<td>Forward-chaining inference engine written in Java (supports backward chaining at design time). Can function standalone, using the features of any J2EE Web Server product embedded in a Java application or deployed into a container (i.e., servlet, session or message bean) within any J2EE application server, including IBM WebSphere and BEA WebLogic. Utilizes a patented “design-time inferencing” technique to determine the optimal sequence of a given set of rules, adhering to all declarative constraints. Targeted at decision automation needs (as opposed to Decision Support applications), where fast design, and reliable and fast execution are essential.</td>
</tr>
<tr>
<td><strong>Corticon Business Rules Collaborator</strong></td>
</tr>
<tr>
<td>Repository-based team development environment for business rules development and management via Web interface; provides facilities for managing rule assets through their lifecycle, including rules versioning and access management, workflow and notification for rule approval processes and rule change impact analysis.</td>
</tr>
<tr>
<td><strong>Corticon Enterprise Data Connector</strong></td>
</tr>
<tr>
<td>Provides enterprise-class connectivity to back-end data sources during rules execution; uses a model-driven approach to data connectivity that requires no SQL coding. Supports business agility and reduces maintenance by isolating rules from data source changes and isolating applications from data requirement changes.</td>
</tr>
<tr>
<td><strong>Pre-built Templates and Patterns</strong></td>
</tr>
<tr>
<td>Corticon provides support for templates that make integrity-safe changes to business rules, but does not offer any specific pre-built templates or frameworks for use with its BRM platform. Rather, Corticon relies on its partners to offer specific industry/application content and templates.</td>
</tr>
</tbody>
</table>

2. **Product Architecture**

2.1. **Architecture Overview**

Figure 1 provides an overview of the Corticon platform architecture, which consists of two main modules—the Corticon BRM Studio and the Corticon Business Rules Server. Additional modules include the Corticon Business Rules Collaborator and the Corticon Enterprise Data Connector.
Figure 1. Corticon Business Rules Management Architecture

Rule Authoring Environment/Graphical IDE: Corticon BRM Studio
Corticon Studio is a standalone business rules modeling and authoring platform that provides a single spreadsheet-like modeling environment designed to support both developers and business users.

Corticon Studio’s spreadsheet-like GUI allows users to capture and model their organization’s best practices, policies and procedures without programming dependency. These models are fully executable, and can be incorporated into existing business applications as standard (XML-based) Web Services.

Corticon Server is the BRE for the Corticon platform. It can function standalone—using the features of any J2EE Web Server product—embedded in a Java application—or deployed into a container (i.e., as a servlet, session or message bean) within any J2EE application server, including IBM WebSphere and BEA WebLogic.

Rules Repository/Rules Database: Corticon Business Rules Collaborator
Corticon Collaborator provides a repository-based environment for managing the business rules (and their associated rule assets) built with Corticon Studio. It supports multi-user team-management features—including check-in and check-out, versioning, security and access control, workflow, and collaborative rules development.

Corticon Enterprise Data Connector
Corticon Enterprise Data Connector provides a direct connection from the Corticon rules engine to relational databases and other data sources. This allows the BRE to retrieve missing data or update data sources directly during rules processing, thereby improving performance and simplifying integration.
Data Connector’s functionality leverages the Corticon platform’s code-free modeling approach and requires no SQL programming skills; all SQL code is generated from the spreadsheet-like rules models created in Corticon Studio.

Enterprise Data Connector offers considerable business agility. This is because rules are isolated from changes to the data sources, and applications consuming decisions (i.e., rule sets) are isolated from changes to input data requirements. For instance, adding rule logic to a loan eligibility decision that requires new data (e.g., customer income, late payment history, etc.) could be accomplished without any modification to the calling application. All of the new data can be retrieved from the external data source by Corticon.

Deployment
The Corticon platform affords various options for deployment and integration, including:

♦ Client deployment—Corticon’s run-time can be deployed directly on a client (with a footprint of as little as 800KB) when deployed as an applet. This option allows rules to run seamlessly within a browser environment, providing a highly-interactive user experience based on business rules

♦ Web services—rule sets are deployed as Web Services and integrated with architectures that can invoke and consume Web Services via SOAP documents

♦ Microsoft .NET framework—rule sets are deployed as Web Services within the Microsoft environment and invoked utilizing .NET Framework and SOAP messaging

♦ Java service with XML payload—rule sets are deployed as Java services (using a J2EE Servlet or EJB interface) and integrated with an architecture that can make Java method calls and transfer XML payloads

♦ Java service with Java object payload—rule sets are deployed as Java services and integrated with an architecture that can make Java method calls and transfer Java objects

2.2. Business Rules Engine
Corticon is an inference-based BRM product that supports forward chaining. It uses backward chaining at design time to support optimization and analysis, but does not offer backward chaining within decision services at run-time, as this would break rule set integrity. Corticon representatives make the case that this is where the distinction between decision automation and decision support is critical. They believe that to support the ultimate goal of decision automation (i.e., guaranteed logical integrity, and reliable and fast execution of decisions), one must give up run-time backward chaining—in effect, believing that the two are mutually exclusive.

2.2.1. Rules Management Approach
The Corticon platform uses a patented data-oriented approach to business rules combined with the application of advanced mathematical techniques (Predicate Logic Matrix) at design time to create optimized and compiled rules sets in the form of decision services with guaranteed logical integrity.

Corticon’s sophisticated analysis tools are designed to assist users with identifying and resolving logical integrity issues, thus guaranteeing conflict-free rules. Design-time inferencing is also used to determine the optimal sequence of a given set of rules, while at the same time, adhering to all declarative constraints.

2.2.2. Enterprise Data Interoperability
Corticon Enterprise Data Connector ensures data consistency of data from external sources through analysis at design time. Corticon’s approach to connecting with external data sources leverages the
analysis features to guarantee logical integrity while isolating rule logic from changes to data sources and hiding the sophistication of external data connection from the user.

2.2.3. Maintaining Data Quality

Corticon deploys and executes decision services (i.e., optimized and compiled rule sets with guaranteed logical integrity) that feature well-defined service contracts with respect to data. And Corticon allows for user-defined data quality rules. Thus, data quality issues are proactively managed at run-time, and the Corticon decision service contract does not allow inconsistent data types to be processed, with data validation rules effectively trapping data values outside a range of interest.

3. Interfaces and Ease of Use

3.1. Development Environment: Corticon Rule Modeling Studio

Corticon’s primary user environment for rules modeling is Corticon Studio, which features one common language that is accessible to both developers and business analysts. This single representation of rules is based on an extended decision-table format.

Corticon has extended the traditional decision-table format to make it capable of expressing the complexity of other technical rule languages, while at the same time, preserving the ease-of-use that has made spreadsheet products ubiquitous. The result is that Corticon Studio looks and behaves much like Excel, and users of all levels of sophistication can use it to model, analyze, test decisions (rule sets), using one common language and modeling environment. In other words, there is no separate language (i.e., developer language) to synchronize with the business user language.

Model-driven Environment

Corticon Studio is completely declarative and model-driven—including rules definition as well as comprehensive rule integrity analysis and business context testing (to verify that rule results satisfy business intent). Even advanced rule language concepts are handled declaratively in the model without requiring any procedural programming.

Corticon Studio features a rich library of operators and business objects that users drag and-drop to construct rules. In addition, natural language expressions of rules are captured and used as reference documentation and as source for messages posted during the course of rule set execution.

Figure 2 shows a screen shot of the Corticon Studio modeling environment. Note that in Corticon’s extended table format, rules correspond to columns, with the condition part of the rule in one section and the action part in another section. Using Corticon’s library of operators and ability to support expressions, users can model business rule logic in a declarative fashion and then analyze, test, and deploy it.

Figure 2 gives several examples of how rules are defined in Corticon Studio. Column one shows a fairly simple rule: IF AN APPLICANT IS ‘MALE’, THEN ADD $100 TO THE POLICY PREMIUM. Column three (highlighted) shows another slightly more sophisticated rule: IF THE APPLICANT’S AGE IS MORE THAN 30, THEN ADD $10 FOR EVERY YEAR OF AGE MORE THAN 30.
Figure 2. Corticon provides a single rule modeling environment—based on an extended decision-table format—designed to support both IT developers and business users.

Figure 3 provides an example of how you can use Corticon to express sophisticated rule logic in a very compact fashion. These rules were created by dragging and dropping terms (e.g., “holidays”, “holiday.xdate”, “policyB”, etc.) and operators (e.g., “-> exists”) to compare a policy effective date with a collection of holiday dates. Note the natural language description of the defined rules that appears in the bottom pane of the screen.

Figure 3. Corticon rule modeling screen showing sophisticated rule logic.
No External Data Access Languages
Corticon’s rule language syntax is free from any external data access language, such as SQL for accessing database data. This modeling abstraction provides isolation from underlying database data and technology changes. First, separation of rule logic from data access details provides agility to organizations in that rule definitions don’t change whenever data sources change. Second, when connecting to external data sources, users simply identify the external source, and are free from any data access coding.

Comprehensive Analysis and Testing Tools
Corticon’s rule modeling environment also provides comprehensive analysis tools to guarantee the logical integrity of a decision (rule set). This “one-click” rule analysis feature helps ensure that rules are logically consistent (i.e., conflict-free, complete, and free of logical loops). Business case testing is similar: users drag-and-drop desired inputs and enter values, then execute rule sets and view the results and messages displayed in a business-friendly format.

Deployable executables are automatically generated from the model. There is no additional manipulation of rule logic to produce a final executable.

3.2. End-User Environment: Corticon Studio
Unlike some BRM tools that provide a technical language designed for developers and templates that enable editing of a subset of rule logic by non-technical end users, Corticon’s model-driven approach features one language and one UI. Thus, non-technical users can fully exploit the capabilities of the Studio’s spreadsheet-based modeling environment.

Figure 4 provides a screen shot of Corticon Studio showing its rules vocabulary (left side of screen) of business objects and operators. Basically, end users create rules and rule sets by dragging and dropping various operators and objects from Corticon’s rules vocabulary. Figure 4 also shows the results of an ambiguity check, where the conditions of the two rules are not mutually exclusive and the actions are different. The ambiguity is highlighted and multiple options made available to remedy the situation.
It's important to note, however, that should an organization desire to extend a subset of rule manipulation functionality (i.e., parameterized rules) to some group of non-technical users, Corticon supports this scenario as well. Corticon supports rule manipulation from Web form templates so that tightly constrained, integrity-safe rule editing can be exposed to authorized users. Figure 5 shows a sample of a Web-based template.

The use of Web forms is important, because it can provide additional flexibility and control to organizations implementing Corticon applications. However, for most technical and non-technical users, the Studio modeling environment is the most appropriate and productive rules editing environment, where users define rule sets in the extended decision table layout, and executable code is generated from the model.

4. Business Rules Expression

4.1. Defining Rules and Rule Sets

Corticon's rule representation scheme is based on an extended-decision table format that makes it capable of expressing the complexity of other technical rule languages, yet still provides the look and feel of a spreadsheet program.

Corticon also supports natural language expressions of rules within a section of Studio, and uses this representation as reference documentation and as source for messages posted during the course of rule set execution.
4.2. Creating and Maintaining Rules

Corticon’s extended decision-table format directly supports users in graphically defining and modeling rules and rule sets. This includes creating decision tables as well as scorecard type rules. It also provides an equivalent, concise representation of decision trees.

Additional rule language constructs enable the construction of scoring rules (increment and decrement rules), and other complex derivation-type rules.

4.3. Rule Templates

As noted previously, Corticon’s primary user environment is Corticon Studio, which uses one common language that is accessible to both developers and business analysts. Thus, there is no underlying technical rules language, per se, and therefore, no need to create an additional language or layer of representation in the form of templates to provide editing functions for non-programmers. In other words, there is no distribution or delegation of responsibility at the individual rule level that might possibly compromise the logical and business integrity of the rule set.

Corticon representatives see this as an important differentiating factor of their product. Because Corticon supports complex rule modeling capabilities (i.e., editing, analysis, testing) using one language, they believe it avoids or reduces some of the issues encountered when trying to synchronize rule sets, languages and interfaces—issues associated with some BRM products that provide separate authoring and rule maintenance environments for IT developers and business users. Basically, with Corticon, there is no “bridging” required to synchronize non-technical user input with the low level rule definitions.

However, as noted (in Section 3.2), Corticon does support manipulation of rules via a Web interface (i.e., Web form templates). Because Corticon can use external data within rules that maintain absolute logical integrity, Corticon can offer Web-based rule manipulation that is integrity-safe.
4.4. Rule Syntax Checking
Corticon Studio checks rule syntax for correct use of operators and correct references to business objects, including data types, and correct syntax in the overall construction of the rules.

4.5. Rule Testing and Tracing
In addition to Corticon’s analysis tools for guaranteeing the logical integrity of rulesets, Corticon offers business case testing tools designed to ensure business intent is satisfied with the rule sets.

Corticon’s primary testing features are the rule set testing tools built into the Corticon Studio. This is a business-friendly environment that allows users to construct test cases in a drag-and-drop manner or by importing from a variety of file formats. Results are highlighted for easier comprehension, as shown in Figure 6.

**Figure 6. Corticon Studio’s Test Environment**

Corticon further enables rule testing and debugging with model-level tools, which allow the user, for instance, to disable and enable rules and groups of rules. In addition, Corticon captures rule set execution data and messages for analysis and auditing purposes. With Corticon’s model-driven architecture, testing and debugging at the model level is the most productive means of ensuring rule sets are correctly defined. However, should the need arise to go beyond the model level, Corticon also provides a testing API to its engine, and code-level diagnostic and execution data for code-level debugging.

Corticon’s desktop modeling environment can test rules deployed remotely across intranets and the Internet, as well as rules that access back-end data sources.

Corticon’s rule testing and tracing capabilities allow you to generate reports showing findings. Corticon’s standard reports document the contents of rule modeling assets. Rule execution data is presented in Corticon’s test environment and is captured in a database for reporting and analysis.
4.6. Multi-User/Team Development
The Corticon Business Rules Collaborator provides a shared repository—accessible via a Web interface—and a comprehensive set of facilities to support deployment, management, integration and ongoing rules modeling and development for team-based projects, including:

Rules versioning and source-code type functionality (with granular access controls) for managing rules assets and projects throughout their lifecycle

Distributed administration—content administrators can set access policies for rule assets in each domain and according to user privileges, ensuring that collaborators, users, and recipients access the appropriate rules and rules set versions

Advanced workflow—including support for due date escalation actions, and alerts to help manage project schedules, etc.

Rule approval processes and rule change impact analysis to identify vocabularies and rules that have been impacted by changes

Subscription services—for sending alerts to users who need to be informed of select activities within the repository, such as an update to a particular rule set or the commentary contributed by a reviewer, etc.

Search tools for finding rule assets that incorporate specific objects or logic patterns, rules vocabulary, English language rules statements, or meta-data associated with rules

Collaborator is intended primarily to serve rule authors, the business community responsible for business policy, and IT personnel responsible for integrating and deploying rule assets throughout the organization. However, it is possible that a company could use Collaborator beyond direct BRM support to manage documents and enable team collaboration.

Corticon Collaborator also makes it possible to gauge the impact of organizational changes on rules. For example, developers can use it to locate all of the business rules that are affected by the change.

4.7. Rules Management and Maintenance
Corticon’s Decision Services Architecture tends to align well with how organizations structure their business authorization: the discrete point of control is the decision, not a part of the decision (rule). With the decision (rule set) as the fundamental point of control, authorized technical and non-technical users can use all modeling capabilities and change and manage every aspect of the rule set defined within Corticon. At any point in time the authorized users can know that the decisions under their control satisfy requirements for logical integrity and business intent. As changes are made to the rule models in Corticon, an impact analysis is generated, showing the business users how the change interacts with the other rules in the application in a way that they can understand and address, without the need to call on programmers.

4.8. Rule Logic Validation and Testing
In addition to tools to ensure rule logical integrity, Corticon offers a testing environment within Studio that enables business case testing to verify rule results satisfy business intent. As with other functions within Studio, business-case testing combines drag-and-drop functionality with the power of the full rules engine.

Test inputs and results are stored as XML, which can be reformatted/transformed to customer’s preferences. (See Section 4.5 for more on business-case testing.)

4.9. Rule Logic Verification
Corticon offers a number of facilities and tools to automate the testing of the logic of rule sets for anomalies and conflicts.

Corticon Studio provides:
Tests for ambiguities and completeness

♦ Analysis tools to check for logical loops

♦ Tests for redundant rules within decision tables

The tool can also collapse tables by removing redundant rules. Corticon has patented unique capabilities with respect to rule logic verification. This is supported by Corticon's Decision Services Architecture and the focus on declarative rule modeling.

4.10. Conflicts and Priorities
Corticon’s rule management and architecture approach enables the platform to automatically detect and completely resolve conflicts at design time. Thus, it does not require the use of rules prioritization schemes and other techniques to handle conflicts and priorities.

Corticon detects and highlights conflicts and provides an override function to resolve rule conflicts. Corticon Studio also offers a rule expansion feature that assists users in creating a complete, conflict-free set of rules. These features allow Corticon to produce optimized, compiled, conflict-free executable decision services. In short, the engine does not have to try to resolve order of execution issues with priorities, because the order has been worked out at design time, and the resulting execution is both reliable and fast.

4.11. Decision Explanation/Auditing
Corticon logs the rules fired with all associated rule statements each time the engine executes. The rule statements provide full freedom to comment on the reasons for rule execution. This enables both technical and non-technical users to understand how decisions were reached.

Corticon also provides for the documentation of rule execution in the test mode of Studio as well as from the server. In Studio’s test mode, users can get instant feedback on precisely how the logic performed and why, enabling immediate editing to the rule set itself and a very quick iterative design cycle. On the server side, such rule documentation serves as an audit trail as well as for providing calling applications with useful data on rule set execution.

5. Simulation
Users can simulate rules and rule set behavior using Corticon’s testing tools. Business/application data can be entered or imported and run through rule set execution in Studio’s testing mode. Results are highlighted and rule messages are displayed. Multiple decisions can be assembled into a sequence within the tester, enabling the output of preceding decisions to feed input to downstream decisions, and allow visibility into how data changes from decision to decision.

In the testing tool, the user can bring in multiple rule-sets (decision services) and order them. Users can then take data and move the data through the flow of decision services. The testing environment pauses after each decision service has processed and shows the user the result (changed data) for the decision step that just processed (along with the rule statements that caused the data change). The user is then able to click on the execute button and it moves the data through the next decision service. In this way, the user can simulate a complex data decision automation in which multiple decisions all come together to create a final outcome.

In addition, the Corticon platform has also been integrated with BPM products (see Section 9.1) to provide even broader scoped simulation of business and application scenarios.

6.1. Document Generation
Corticon Studio generates XML or HTML files documenting vocabularies, decision services (rule sets), and tests. It provides standard HTML reports, as well as an XSLT transformer to help developers turn XML documents into custom reports.

6.2. Document Management
Corticon Rule Collaborator provides integral document management functions, including version and source control and workflow. It manages all documents in a central library, and provides controls for versioning and access. You can also add documents to the library and access them via the Web.

6.3. Interfaces to Third-Party Document Management Systems
Corticon works with third-party source control and document management systems, enabling companies to employ a single source management product to manage all application assets. Corticon's assets are file-based, which document management systems and source control systems can easily manage.

7. Development Environment

7.1. Programming Languages and Support for Open Standards, Components and Frameworks.
Corticon is written in Java and features a model driven architecture. Studio provides a complete rules modeling environment for defining rules, analyzing rules for logical integrity, testing rules for business integrity, debugging rules and generating executable (i.e., optimized Java byte) code that runs on the Corticon Business Rules Server.

The Corticon platform is extensible, supporting any Java service to participate in rule set execution as an “extended operator”, thus preserving rule set logical integrity. Corticon rule sets are deployed as Java services or as standard (XML-based) Web Services that integrate into standards-based environments such as J2EE and .NET.

7.2. Software Models and Code Generation
Central to Corticon’s model-driven architecture is the generation of executables from the models created and maintained in Studio. These executables are deployed, without modification, on the Corticon Server to ensure optimum performance and reliability. In producing compiled, optimized executables directly from the model, Corticon can ensure logical and business integrity, and accelerate the rule set design and maintenance cycles.

This approach differs from the traditional software development model involving generated code, which may require further modification before deployment, and which ultimately gets compiled or interpreted at run-time.

7.3. Maintenance and Update Support
The Corticon platform supports version management, “effectivity” controls (i.e., when a rule set is valid, such as during a specific period of time), and automated change processes coordinated by the Corticon Collaborator tool to manage change. With its syntax and analysis tools, Corticon can detect and highlight changes that create inconsistencies, thus accelerating the maintenance cycle.

7.4. Integration with Third-Party Development Environments
Corticon Studio integrates with IBM Rational Rose in that object models exported from Rose can be imported into Studio to create the rules vocabulary.

Corticon decision services are designed to integrate via Web Services or Java, and can be tested from any number of development environments, including but not limited to, MicroSoft Visual Studio.
8. Methodology Support

Corticon representatives stress that Corticon Studio provides a flexible rule development environment that is compatible with any rules discovery methodology. However, the company has developed its own proprietary methodology that is aligned with Corticon’s Decision Services Architecture.

A fundamental premise of the Corticon methodology is that business policies incorporate critical business decisions, and that these top level business decisions often can be decomposed into a hierarchy of business decisions. With this viewpoint, a blueprint of decisions can be formulated, relationships between decisions and with data and processes can be described, ownership can be established, and decision logic requirements initiated or consolidated.

The Corticon methodology extends through design, implementation, test and deployment, as well as change cycles. And Corticon’s products—particularly Studio and Collaborator—are integrated with this methodology.

9. Integration

9.1. BPM Suite Integration
Corticon has integration agreements with numerous BPM vendors, including Adobe, Chordiant, Fuego, Global360, Handysoft and TIBCO.

Corticon’s use of Web Services as a primary rules interface makes it straightforward to integrate Corticon rules-processing capabilities with a wide variety of BPM/workflow products.

9.2. Production Systems and Third-Party Applications
Corticon supports several open standards for integration, including XML, UDDI and SOAP, and JMS.

9.3. Web Services/Service Oriented Architecture Deployment
Corticon was designed from the ground up to support SOAs. Rule sets can be deployed as independent or embedded Web Services or as Java artifacts within application programs. And WSDL/XSD Service Contracts are automatically generated for each rule set as part of the deployment process.

9.4. Messaging and Middleware Integration
Corticon provides a set of (general) Java APIs, but has not created APIs tailored for specific middleware systems.

Corticon supports the following application servers/middleware/transport:

- Apache Tomcat
- BEA Weblogic
- IBM MQ Series
- IBM Websphere
- Iplanet
- Tibco Rendezvous
- J2EE
- JMS
- RMI
9.5. Database Support
Corticon works with Microsoft SQL Server, Oracle, IBM DB2, and HSQLDB.

9.6. Predictive/Analytic Modeling Support
For models that are exposed in database tables, XML, or services, Corticon can map rules vocabulary to the data. The Corticon architecture provides additional integration options, including the use of extended operators to implement any Java method to employ predictive or analytic models.

Corticon also has the ability to integrate with analytic models while preserving the advantages of its declarative rule-modeling paradigm designed to guarantee logical integrity of rule sets.

10. Templates and Frameworks
10.1. Horizontal and Vertical Industry Templates, Frameworks, and Pre-Built Rule Bases
Corticon does not offer any specific horizontal or vertical industry templates, frameworks, or pre-built rule bases for use with its BRM product. Rather, Corticon partners do offer vertical industry rules content.

10.2. Domain-Specific Knowledge Products
Corticon’s partners offer vertical industry processes and rules.

10.3. Domain and Industry-Specific Packaged Rule-Based Applications
Corticon does not offer any pre-built or “packaged” domain or industry-specific application.

11. Administration and Security
Corticon provides design-time security via Corticon Collaborator. Collaborator’s administration features include ID passwords and logons. Developers can also integrate third-party source control systems for design-time management.

Corticon relies on external authorization systems for runtime security. In addition, like most BRM applications, Corticon is typically deployed within a container where security is provided by the application server itself. Security governing the execution of Corticon decision services, therefore, is enforced in the same way it is for any service within the control of the application server. The protocols and products used to manage security can include those supported by the application server, including LDAP and Active Directory based systems.

12. Platforms
The Corticon BRE runs on any operating system with JRE 1.3 or higher, including Windows 2000, Windows XP, Solaris 2.6 and higher, AIX 4.3 and higher, Red Hat, and SUSE.

Corticon can access and update data in a number of sources including relational databases like Oracle, IBM DB2, Microsoft SQL Server, and Apache Derby.

13. Scalability
13.1. Vertical Scalability
Corticon can be deployed as a service hosted by an application server. In this configuration, scalability can be achieved in a number of ways, including scaling hardware, clustering, and replication. In addition, Corticon decision services also take advantage of the application server’s scalability features.

13.2. Horizontal Scalability
Corticon can be deployed as a service hosted by an Application Server. In this configuration, scalability can be achieved in a number of ways, including scaling hardware, clustering, and replication.
14. **Business Rules Standards and Industry Groups**

14.1. **Industry Standards Initiatives**
Corticon monitors and participates in various industry standards rules initiatives, including the OMG Production Rules Representation (PRR), the OMG Semantics of Business Vocabulary and Rules (SBVR), and the W3C's Rules Interchange Format (RIF) effort.

14.2. **Business Rules Consortiums, Groups and Conferences**
Corticon is a Platinum sponsor of Business Rules Forum.

15. **Pricing**
Rule Modeling starts at $10,000, with initial projects averaging about $100,000 in software license.

Corticon also offers a wide range of services and support (see Sections 16.3, 16.4, and 16.5), including tailored services available on a project or time-and-materials basis.

16. **Company, Product Positioning and Support**

16.1. **Company Background**
Corticon is a privately-help company that was founded in 2000 by Dr. Mark Allen, a former MD (and the company's current CEO) who has extensive experience in implementing rule-based applications for clinical and healthcare best practices.

In addition to its headquarters in San Mateo, California, USA, Corticon has two offices located in Los Angeles, California, and Washington D.C.

16.2. **Positioning**
Corticon has approximately 65 customers, many of which are in the financial services industry, where decision automation within process-driven applications is a critical success factor for their business. It’s important to point out, however, that Corticon does not exclusively focus on this area, but rather targets opportunities for automating a wide range of decisions.

Corticon sells, distributes and supports its products in North America, Europe, and Asia-Pacific.

16.3. **Educational Training/Product Training**
Corticon offers support, implementation and training services, including a focused “train-the-trainer” program. Since a large percentage of revenues are from partners reselling the Corticon solution, attention is focused on enabling those partners.

16.4. **Product Support**
Corticon offers telephone and e-mail support, with support levels offered ranging from basic (i.e., within normal business hours) to premium (24x7). Customers may also request on-site support from Corticon professional services personnel, if desired.

16.5. **Consulting Support**
Corticon offers a range of consulting services and training classes covering business rules modeling (including requirements analysis), business rules automation (including architecture design and prototyping) and application development support (including integration/deployment and post implementation support).

17. **Case Study: Corticon at the LexisNexis Group**

17.1. **Context**
The LexisNexis Group provides information to legal, corporate, government and academic markets, and publishes legal, tax and regulatory information via online, in hardcopy print and CD-ROM formats.
The global legal and information division of Reed Elsevier plc, LexisNexis Group offers searchable access to more than three billion documents from thousands of sources with leading edge systems and content management tools. The company offers Lexis service, the first commercial, full-text legal information service, and Nexis news, financial and business information service.

17.2. The Challenge
In 2004, LexisNexis was faced with lengthy, costly, and complex processes for entering, routing and fulfilling new customer orders within its Lexis service. When the company began investigating technologies to help automate order processing, reduce operational risks associated with errors in processed orders typically associated with inconsistent business decisions, and alleviate the burden on information technology (IT) staff, it turned to Corticon Technologies.

The LexisNexis vision was to achieve unified order fulfillment through a new Customer Order Management System that would automate the validation, routing and fulfillment of orders coming into the company via phone, Web, and fax.

17.3. The Solution
Corticon provided LexisNexis with a complete Business Rules Management solution to help create new customer accounts—accounts previously processed and managed by a custom application that required costly continuous development and technical resources.

“At LexisNexis, we're utilizing Business Rules Management software from Corticon so our business users have the flexibility to create, change and manage the majority of their business decision logic without much IT involvement,” said Steve Iddings, Director of Applications Integration at LexisNexis. “Corticon has demonstrated to us that their rules automation software can reduce project costs and increase the quality of our business rules logic.”

The Corticon Studio modeler environment allows LexisNexis business analysts to capture, validate, test and manage business rules without the need for in-depth programming expertise. As a model-driven environment, the spreadsheet-like rules models are automatically converted to executable Web Services. While Corticon’s service-oriented architecture (SOA) enables LexisNexis to take the common set of business rules that come together to make up a business decision, and package and deploy that decision service as a Web Service. This allows business logic that might be needed in multiple applications to be managed as a common decision service.

17.4. Result/Benefits: Significant Reduction in Operating Costs
The Customer Order Management System at LexisNexis was established to achieve unified processing by automating validation, routing and fulfillment of orders coming into the company via telephone, Web, and fax.

Corticon was tapped to accomplish some significant goals, including ensuring orders were processed consistently, allowing orders to be successfully and accurately handled by fewer people than before, lessening the time it took for the company to fulfill orders, and reducing the time-to-market for new and/or improved LexisNexis products. Because the Corticon solution automates business rules, there is no need for custom coding as LexisNexis required before the implementation.

“The first priority for us was order automation, which would allow us to automatically maintain rules without technical expertise,” said Carter. “Corticon allows us to make intelligent routing decisions about customer orders. For instance, in the case of a new order, the system determines things like the customer’s market, the parameters for their account, general subscription attributes, and the billing setup. Prior to Corticon, we had to custom code everything, which required a development resource to maintain the process. The costs related to that requirement are now much lower—we need technical input only occasionally now. The development lifecycle is significantly shortened.”
17.5. **Solution Agility Eases Rules Creation and Management**

“With the agility we get with Corticon comes the ability to resource a project more easily by assuming
the analyst working on it can get close enough that it doesn’t require three staff months’ worth of
development effort to write the rules,” said Carter. “We’re now faster and we’ve offset the allocation
of technical resources on each project. I’d estimate it takes 50% to 70% less time to complete a
project—that’s a huge savings. The Corticon system also gets the fulfillment organization more
involved in the business process, and as they begin to understand each type of customer, they
become more knowledgeable with every order.”

17.6. **Operational Risks Reduced**

Decision automation must be precise, and Corticon’s approach is to first analyze rules for
correctness and then provide a testing capability that requires no programming or classic QA
organization. In other words, Corticon helps LexisNexis determine whether their business decisions
are correct and appropriate from the start by providing tools tailored specifically for business users as
opposed to IT personnel. This approach is far more beneficial to the bottom line than the alternative
approach of trying to test quality into the business logic.

Classic testing is hit-or-miss due to the complexity of decision logic. LexisNexis appreciates the
quality control the approach provides for its bottom line. “If an analyst working on a project enters
something incorrectly, Corticon will catch that and ensure accuracy,” said Chuck Carter, Senior
Software Engineer at LexisNexis. “Once again, it removes the need for programmers to step in, as
well as eliminating risk involved with erroneous business decisions caused by human errors made
during the process of defining and creating the rules.”

18. **Company Offices**

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