Business White Paper

Revolutionizing Application Design, Development and Maintenance

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About This White Paper:

This white paper provides an overview of the impact of rule management technology. It shows how Blaze Advisor from HNC can take you "Beyond Personalization" and how it can revolutionize your application design, development and maintenance. It describes the benefits of rule management technology and shows how this technology can be a part of the scalable, distributed, multi-channel architecture of the future.

Why We Use the Word "Revolutionary"

This is a strong claim, so we feel we owe you a direct explanation. Rules management technology is revolutionary because:

1. It allows non-technical individuals to change business rules in major production systems or in personal mobile service applications without any help from IT or the service provider. It delivers revolutionary improvements in operational efficiencies and adjusting to changing conditions.

2. Rules management technology provides revolutionary improvement in the ability to store, review, and analyzebusiness policies and procedures.

3. By separating business rules from procedural code, the technology profoundly changes the way applications are designed, built and maintained. In some ways the set of changes beginning to be generated by the adoption of rule management technology rivals those generated by the integration of relational database technology into the development process.

What Do We Mean by "Beyond Personalization?"

All across the e-business landscape, information system vendors and their customers are talking about "personalizing" interactions between applications and those who use them.

Simply put, many of today's personalization technologies fall far short of what is really required. When visiting a Web site, it might be nice to be reminded that the site remembers your name based on some cookie saved on your browser. Sometimes it is useful to get suggestions that people like you also buy Harry Potter books. And it could be somewhat reassuring to know that if you have a lot of money you are classified as a "Platinum" customer. But truly we can now do much more. We can go to a place we call "Beyond Personalization."

Beyond Personalization is not just a new way of thinking about software applications, it is also a specific destination. It is a place where business process management meets business process personalization, and both meet the multi-channel communication options that characterize the 21st century style of computing. These channels include PC-based Web browsers and a growing range of mobile devices. Beyond Personalization is a place where a triggering event can take information from almost any source and combine it in real time with precise, relevant business rules as well as the user's individual profile or specific history with your organization. It is the desired destination of most external and many internal Web applications. It will soon emerge as the foundation for intelligent mobile applications.

Viewed from an enterprise business perspective, rules management technology is truly revolutionary. It greatly enhances business control over enterprise computing, and it dramatically improves the end user's experience, with efficient self service business process management and quantum leaps in personalization and service.

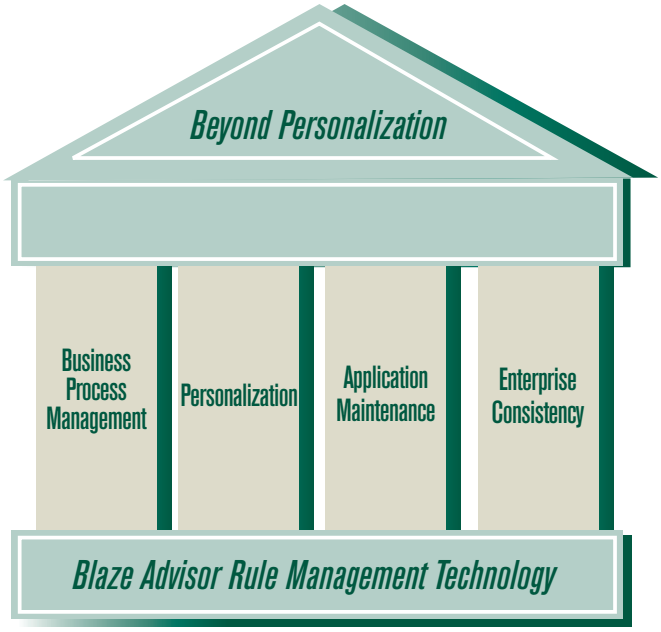
This paper outlines our view of rules management technology's role in computing today and some of our plans for the future.

The Four Pillars of Beyond Personalization

When we think about Beyond Personalization, we focus on four key business and operational requirements or pillars. If all four pillars are provided, our Beyond Personalization house should stand firm. Providing these pillars to our customers is the mission of Blaze Advisor rules management technology.

1. Support of Business Process Management

Enterprises run their businesses with repeatable business processes driven by general business rules with specific rules for specific situations and customers. Thus, supporting the process requirements of business is fundamental. Rules, at their most elemental level, are just clearly expressed "If X is true



The four pillars of Beyond Personalization

then do Y" statements. But rules need to collaborate and work together to complete a business process, and they need to be easy to build and manipulate in modular units with adequate controls. In addition, process support requires that rules can look up information from diverse sources and create temporary records to allow calculations and decisions to be collected and stored in memory. Rules need to calculate values and make assessments. Missing and unavailable data events must be handled gracefully; questions may need answering. Finally and most importantly, rules are evaluated or executed in a sequence.

Taken together, these capabilities represent the business process management pillar — allowing enterprises to do business using independent rule services made up of executable, sequenced, declarative rules, rather than being forced to write embedded, procedural computer code.

2. Support of Personalization

This pillar means supporting the growing expectation that software applications should respond holistically to the person with whom they are interacting. Sometimes this takes the form of individual or account information displays that are viewed as relevant or appropriate prior to knowing what the user is interested in seeing. Some people describe this as a "context" that is tied to the user or account. Sometimes it involves asking appropriate questions so that the user can provide information that will drive personalized communication. In other instances, it involves making educated guesses and presenting information based on either click stream data or based on user profile/category information. The focus of the personalization effort can be the user of a customer self-service application, the subject – an employee or a consumer. In all cases, it involves providing the right information to the user at the right time. This is increasingly viewed as a key differentiator in the provision of customer service and in the creation of an effective customer relationship management environment.

Only rules management technology can provide the flexibility to personalize applications based on any combination of group profile, individual profile, or transaction history associated with an individual application user or subject. And only rules management technology can drive the display of such a wide range of information in the right place, at the right time.

3. Support of Application Maintenance

Going "Beyond Personalization" requires a new application maintenance paradigm that can deliver faster, easier application modification. Business rule changes are first identified by the responsible business people. They are often domain experts and process owners who have the authority to authorize application modifications within their area of responsibility. Personalization rule changes are identified by either business personnel or individual users themselves. The fastest and safest way to empower these people is to give them the tools they need to make the application changes themselves. This can be achieved by giving them access to easy-to-use rule maintenance applications that allow them to maintain the policies, procedures and rules for which they are responsible. And for more and more applications, control belongs to the individual in a user-centric world.

By taking IT "out of the loop" for everyday application maintenance, advanced rules management technology can make applications more adaptable and less vulnerable to staffing and skill set shortages.

4. Support of Enterprise Consistency

This refers to the long standing but elusive software development goal of "write once, deploy anywhere." As the number of applications in an enterprise grows, specific individual pieces of business logic are needed in more and more places. Increasingly, different applications with overlapping or identical purposes are being deployed over different communication mediums. Web customer self-service applications, call center applications and mobile applications are obvious cases in point. When business rules change, it is increasingly common that more than one application must be changed. And when business rules change, all application changes should generally be done at the same time.

By separating business logic from application code, Blaze Advisor rules management technology allows the creation of sharable business logic services. This means that the same business logic (such as how to treat "Platinum" customers, or whether a customer is eligible to buy a type of insurance) can be applied across multiple customer touchpoints including the increasingly important set of mobile devices.

Summary

We believe that organizations reaching Beyond Personalization will achieve a significant competitive advantage. Organizations that ignore any of the four pillars will risk their reputations and their ability to react to market changes at "Internet speed."

Rules Management Technology

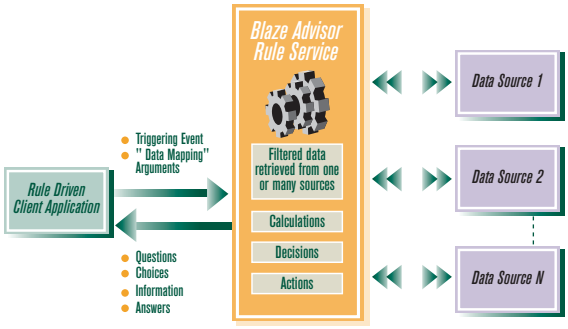
Rules management technology has been around in various forms for over 20 years. It was first used widely in the mid-80s when expert systems or "Artificial Intelligence Technology" became briefly popular. Companies were faced with the need to combine domain expertise with the flexibility to write lots of "if x, then y" statements over a wide range of variables without resorting to spaghetti code. Computer scientists and programmers began developing rule languages and the corresponding engines that could handle the conditions and actions needed to satisfy the wide range of rules that needed to be written.

There have been many efforts to commercialize expert systems. One of the most successful branches was initially referred to as "production rules." In this branch of rules management technology, real world rules are expressed in "if-then" form with the ability to use functions (or calculations) and data objects as necessary. Since an application could have hundreds of rules, an efficient representation and execution scheme was required to quickly identify the subset of rules that were relevant in a given situation. As those rules fired, the execution scheme would quickly identify the next set of relevant rules. The most successful approach for doing this has proven to be the Rete algorithm developed at Carnegie Mellon in Pittsburgh in the 80s. Named after the Latin word for comb, the Rete algorithm quickly identifies all rules relevant to a given set of conditions and scales very well into rule bases with thousands of rules.

Over the last ten years, rule engines have evolved beyond their expert systems heritage by adopting distributed object technology such as EJB and COM+ and thereby integrating diverse information sources. They have also developed simpler and easier to understand syntaxes for writing rules, gained substantial performance improvements, and added extensions for rule sequencing, branching, maintenance and function optimization. Blaze Software, previously under the company name Neuron Data, has played a significant role in this history of research and development.

The Blaze Advisor rules management system leverages this history and provides easy-to-use, comprehensive rule service design tools and a complete deployment system that provides

high speed, scalable rule service execution and management in either EJB or COM+ environments.



Very simply, client applications trigger events and send context which allows the rule service to provide information, offer choices, ask questions, and make decisions.

Benefits of Rules Management Technology for Application Development

Rules management technology delivers a set of very specific benefits to application developers. The material benefits for most anyone with responsibilities for application development are presented in this table:

How Do Organizations Benefit from Independent Rules Engine Technology?

- Faster Application Development
  - Separation of rules from procedural code
- Fast Response to Change
  - Business staff given control over business logic
  - Write once, deploy in many places
- Reusability of Work
  - Reuse your business policies and rules across applications and across your "extended enterprise"
  - Reuse enterprise data across applications
- Lower Total cost of Application Development & Ownership

These application development efficiencies provide significant cost savings as well as "responsiveness" benefits. Technology that allows non-technical domain experts and managers to maintain changing business logic themselves eliminates "information transmission" losses as well as the cost of unnecessary IT project work. Technology that allows most databases in an organization to be accessed and referenced in the execution of application logic eliminates the need to design and build redundant databases and data warehouses. Technology that allows big and small logic modules to support multiple applications is inherently more cost effective both in the development phase and, more importantly, in the application maintenance cycle. And for some organizations, technology that allows you to create a single application that supports a major business process while perfectly serving the specific needs of each individual channel partner or Application Service Provider client can provide significant new business opportunities.

Functional Requirements of a Complete Rule Management Solution

Rule management systems require a number of capabilities to be successful. There are at least eight major ones in a complete system, including:

1. The ability to use and refine existing object/data models.

2. The ability to interoperate with existing data sources.

3. Sophisticated rule syntax allowing executable rules to be written in standard English sentences that can be easily understood by non-technical people.

5. Testing and management tools to handle complex rule bases – tools that support rule service partitioning, execution path testing, service assembly and service deployment.

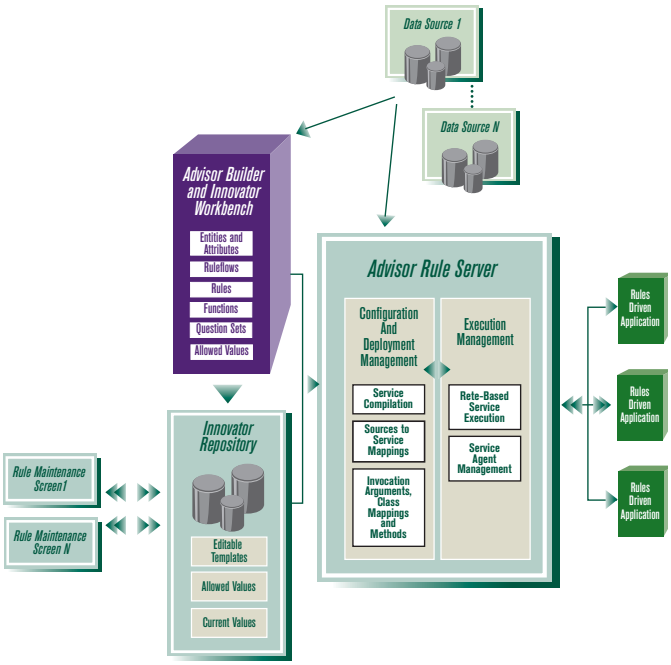
6. The ability to generate rule maintenance applications that completely hide the structured rule language -

applications that allow rules to be safely constructed and modified by the right people with the right data entry controls.

7. Frameworks for the reuse of rule structures and the sharing of rules to support enterprise consistency as well as the specific requirements of user-centric applications and the application service provider business model.

8. Scalable and schedulable deployment of rule services across one or many applications on one or many hosts in a large distributed computing environment.

Blaze Advisor from HNC provides a complete rules management system that includes all of these functions. How you build applications with Advisor is profiled in a separate white paper titled "How Blaze Advisor Works." A review of several complementary technologies follows, as well as examples of some of the many business processes that are taking advantage of rules management technology.



Cooperation With Other Technologies

There are many new technologies under the general banner of e-business infrastructure and personalization. It is often hard to distinguish clearly between them. Many can be used in combination with rules management technology to deliver state-of-the-art applications. Here is a list of some popular technologies that are often helpful in building personalized customer-facing applications with a short summary of what they do and how they can work with rules management technology.

Collaborative Filtering

This is recommendation engine technology that makes suggestions or presents information based on what members of a pre-defined demographic category have done or have identified interest in. Collaborative filtering is useful for providing initial information or candidate lists. It is also commonly used for product recommendations or suggesting alternatives when requested items are out of stock.

Business rule services defined using Blaze Advisor can look at multiple data sources and take advantage of external application services. As a result, a recommendation engine such as the one provided by Macromedia LikeMinds can be used in conjunction with rules designed using Advisor. One common example would be for Advisor rule services to handle control over content display and promotional offerings and for LikeMinds to make rules-driven cross-selling suggestions in an integrated fashion.

Data Mining

This technology handles complex queries against large databases. Rule management technology working with data mining technology allows you to launch business services that initiate specific analysis and return specific answers to a calling application. Rule service technology operationalizes discovered knowledge. Now data mining can actually help manage

transactions and personalize customer-facing systems. Compaq's Zero Latency Enterprise Solution framework features the use of Blaze Advisor's rule service technology to launch, receive and utilize data mining queries.

Workflow Management

When people discuss workflow technology, they can be talking about two very different things. The first is a process management capability with sequence and branching. The second generally involves document completion and approval management. Blaze Advisor rules management technology successfully handles process management if a process works its way through to completion. Rule service technology also supports interactive dialogs and a wide range of rule evaluations. However, rules management technology does not support document management or inbox-type approval sub-processes. These activities typically require specialized workflow and/or document-oriented file server applications.

Search Engines

This segment of the software industry uses proprietary algorithms to search the Web for relevant content and relevant sites. Rule-driven personalization efforts are often asked to include the rule-driven delivery of filtered Web search results as part of delivering informational services to users.

Web Content Management

This application software category covers a range of content related capabilities from authoring to storage to display rendering using multiple devices. Blaze Advisor rules can "personalize" the content displayed in an application by working with the meta tags provided by content design, management and storage vendors such as Interwoven, OpenMarket Documentum and Vignette.

CRM and Customer Interaction Management

Major CRM Systems are increasingly composed of two major components. The first is the traditional database application provided by vendors such as Siebel, Oracle, Clarify/Nortel and Vantive/Peoplesoft. The second is advanced customer interaction software that integrates voice, e-mail, web chat and web call back communication channels with call center operation and management software. Leaders here include Aspect Communications and Apropos.

Rules management technology can assist CRM applications in virtually all sub-categories. Rules can help with lead assignment, product configuration, promotional offers, product recommendations and contract document selection/construction for people engaged in selling.

Customer segmentation, targeting and information delivery rules can significantly improve marketing initiatives. All of these things can help e-commerce applications that are attempting to personalize selling, marketing and order entry. On the customer support side of CRM, call routing, escalation and notification rules as well as account history information display rules can assist customer service personnel, while diagnostic and preventative maintenance rules can help field service and product support employees.

Rules management technology becomes even more valuable with the growing sophistication of customer interaction management software where interactions need to be processed consistently and systematically regardless of communication channel. Increasingly, sophisticated interaction routing and escalation rules must consider many things — subject, communication channel, customer attributes, customer history and customer service goals, while web call back requests and e-mail messages will need increasingly personalized responses. The CRM database application and customer interaction/call

center vendors can certainly extend their solutions by taking advantage of rule management technology.

Product Configurators

Product configuration modeling tools and end user applications that utilize configuration models have much in common with the design tools and uses of rules management technology. Product configurators enforce compatibility constraints, product requirement rules, resource consumption rules, optimization functions and a logical way to walk a user through a complex product configuration process. The areas of distinct value-add relative to general rule management technology are the areas of capacity/resource consumption monitoring and the provision of function optimization algorithms using the algebraic constraints associated with linear programming. This technology, however, has typically been developed with the end goal of providing a constraint-based list of valid line items on a sales order. In contrast, rules management technology focuses on the general purpose needs of business and consumer applications. Rules management technology handles many product configuration problems every bit as well as specialized product configuration software. Certain product configuration problems require the special capabilities offered by this application software segment.

Application Server Platforms

Many application server platform vendors are now offering a combination of services. IBM, BEA, and Sun all offer platform "packages" that combine various capabilities from multiple categories, ranging from EAI adapters to application development tools to gateways. Rules management technology has become increasingly important to all of these technology leaders.

Summary

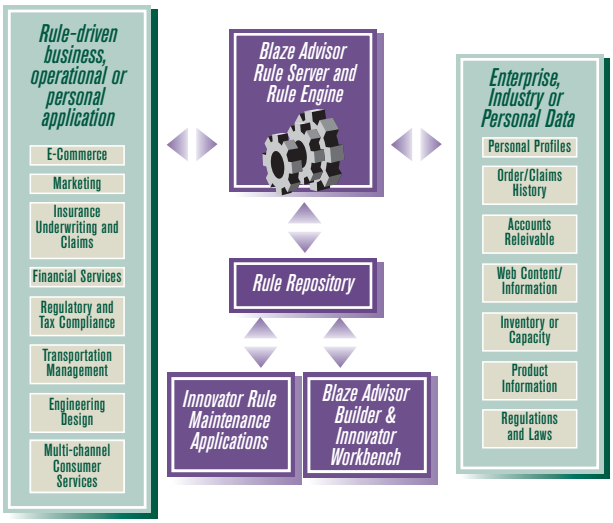
As you can see from this partial list, there are many worthwhile technologies that can work cooperatively with rules management technology to help you get "Beyond Personalization". It is important to pick the right tools for each individual job and to adopt an overall application architecture that allows all of these software components to work together. Blaze Advisor standards-based rules management technology provides a key component in such application architectures. Key standards include support for J2EE, COM+ and XML W3c.

B2B, B2C and E2B Applications All Benefit from Rule Management Technology

There are many business processes that can benefit from the use of rule management technology. Many organizations have been dissatisfied with their application development process to one degree or another, and many have been frustrated by the difficulty they have modifying their applications, packaged or custom-built, at Internet speed.

Rules management technology can be useful in all types of applications: B2C, B2B, E2B. They all have repeatable business processes (rules); they all require access to diverse information sources to supply the context for the rules; many can require the use of multiple client communication devices; and most need some degree of personalization.

As an example, in the insurance industry a B2B selling application might require logic that can evaluate risk based on the applicant's industry and number of employees or building type and square footage; but it might also require evaluations of total business history across multiple policies (payment history, claims, total revenue) as well as a Dun & Bradstreet credit evaluation. In contrast, a B2C selling application might only need



to look up payment history. As a value-add, it might also want to differentiate the company from its competitors by the quality of useful and appropriate information that is presented to the Web site visitor during the policy selling process. In the case of the B2B application, sophisticated algorithms and complex data look-ups are required to support the risk assessment and underwriting (pricing) processes. The B2C logic and data look-ups might be less complex. The content retrieval and display in the B2C scenario might be more complex however, with the presentation of relevant information sourced from company databases, Web content management systems and the Internet.

In both cases, a temporary insurance policy application record was required to store the information being collected. And in both cases, the independent rule management architecture proves critical. It allows underwriting and regulatory compliance rules to be quickly and easily modified by non-IT people in different departments and in different states.

Process Examples from Business and Government

Business rules are ubiquitous. Most applications have rules. Historically, some have been housed in database tables so that a single piece of procedural code can look-up and apply the relevant rule (record) in a given situation. Others have been written out, rule by rule, in the application's procedural code. Industries are attracted to independent, external rules management technology for several reasons:

1. Their rules are complex and conditional and need to be reviewable and treated as a corporate asset.

2. In practice, business or personalization rules need to be applied to information sourced from multiple databases.

3. Business rules change frequently and need to be modified by business personnel.

4. Rules need to be utilized multiple times within or across applications.

The following processes can all benefit from the use of rules management technology:

Insurance Risk Assessment & Underwriting

The insurance selling process involves numerous rules. There are many variables in the risk assessment and underwriting processes, and many forms of insurance have to adhere to state or national regulations. These regulations can be quite general, and they can also be quite specific to a given industry or demographic group. There are also business policies that reflect an insurance company's strategies and attitudes towards profitability, market share, etc. Most insurance companies have developed custom applications over the years and have problems with application modification backlogs and high IT costs. Rules management technology provides critical relief for this industry.

Consumer Financial Services

Loan, credit card and mortgage applications are the bread and butter of this huge industry. Rule engines do an efficient job of applying rules to the evaluation and origination processes. But increasingly, businesses providing consumer financial servic-

es need to differentiate themselves based on customer service and the provision of a wider range of services. In other words, the world of consumer financial services is becoming a giant electronic shopping mall with department stores and specialty stores. Every store's advertising, selection and prices are easily seen; but consumers only have so much time. So they trade off between the conveniences of one stop shopping and familiarity and the special options and offers provided by the specialists or those attempting to gain market share through aggressive marketing. It is a very competitive area with many of the same dynamics that characterize e-commerce in general. However, the rules and algorithms and some of the technical requirements are quite different. As with insurance and health care delivery, credit and loan approval processes can also fall under government regulation. As a result, there can also be special needs in the areas of reporting, compliance and auditability. Retail online brokerage is also an increasingly large area. Trading and margin request rules apply on the front-end and trades must be processed correctly in the execution systems. A great deal of context-specific and personalized content must be displayed. Rules management technology helps enormously with these kinds of process requirements.

Claims & Reimbursement Management and Fraud Detection

Whether the payer is an automobile company, an insurance company or a government agency, the servicing of reimbursement requests and the processing of event claims are rule intensive processes. Claim and reimbursement rules differ from automobile warranty to healthcare delivery to workers' compensation to automobile, life and property & casualty insurance. Rules management technology can help in many ways. Rules can provide interactive dialogs that ensure application completeness under many specific conditions. Rules can validate coding standards compliance, an issue of particular concern in all areas where we depend upon government databases and reporting. And rules can determine payment.

Fraud detection is a special process that sits on top of a claims and reimbursement process. Some tests are simple and mechanical but need to be done as part of the process. Other tests are complex and involve looking at multiple databases and applying many rules. Sometimes the results are definitive, and other times they just produce a list of exceptions that merit human attention. Rules management technology can help both in interactive applications and batch processing.

Back Office Financial Services

In the back office, brokerage firms must manage complex transaction routing and the reconciliation logic required to deal with the diverse set of exchanges, confirmation and matching services, depositories, agent banks and investment advisors. With rapid structural change in global trading technology, brokerage firms find themselves having to constantly adjust both business and transaction processing rules. Rules management technology is a tremendous benefit in brokerage back office applications. Banks also have back office operations that benefit from transaction management and rule-based evaluations. Cash management, for example, is a highly rules-driven process.

Tax Compliance

There are literally hundreds of income tax compliance tests that gauge estimated tax payments, current vs. previous year comparisons, taxpayer reported income vs. financial industry reported income, etc. Sales tax and payroll withholding tax payments by businesses can also be assessed using rules technology. All such tests can be done in batch with rule-driven decision actions updating or inserting database records. Tariffs and duties associated with moving physical goods (or even services) across national or jurisdictional lines can also be generated or validated using rule management technology.

Regulatory Compliance and Provision of Governmental Information

One of the biggest concerns government agencies have is having the ability to enforce regulations. The Internet makes it possible for government agencies to improve operational processes. It makes it possible for them to explain why regulation is necessary and even desirable. It also give agencies the ability to help people navigate efficiently to the regulations and requirements that govern what they do, and it eliminates the need to take time off from work to go down to the government office. The Internet can deliver an interactive dialog that allows the user to work with the government's most knowledgeable domain expert. And the Internet can provide data entry forms that ensure completeness of filings. Rules management technology can provide enormous advantages to government agencies in terms of data collection and validation, information dissemination, compliance management, personalization and customer service.

E-Commerce Merchandising

For centuries, retailers have competed on the basis of selection, list price, discounts or promotions, and customer service. Rule engines can drive simple product configuration, cross-selling and up-selling recommendations as well as highly tailored discounting. Rules can also drive content presentation at the same time. In other words, rules can support all of the dimensions of competition: selection, price and service. Rule management technology provides a much more comprehensive, flexible and precise solution than the database-centric solutions provided by traditional ERP and CRM application vendors. The combination of rule management technology with e-commerce product catalogs, shopping baskets and credit card payment processing is a proven winner. Ancillary processes such as freight charges or tax calculations can also be supported. When e-commerce applications fall short in terms of capability, rule management technology is able to contribute enhanced functionality and greater precision, filling in holes and extending service. IBM Web Commerce Suite and Blue Martini Software are leading packaged applications that use Blaze Advisor's rules management technology.

Marketing

Marketing, of course, covers a lot of territory with needs differing somewhat between B2C and B2B. But the fundamentals are extremely well supported by rule management technology. Take two extremes for the sake of illustration. A retail giant with thousands of stores might need to plan promotions and inventory levels for their individual stores. This might require them to perform sophisticated data mining to compare individual store sales patterns based on geography, demographics, advertising expenditures and pricing. All of this historical and "what if" analysis needs to be converted into individual store sales plans. Data mining technology in conjunction with rule management technology easily beats the traditional approach of massive batch reports and disconnected Excel spreadsheets.

At the other end of the spectrum, if an individual provides a marketer with a profile and signs up for a permission-based marketing service, the marketer needs a rule engine to manage which e-mails, literature, offers and requests to send to that person based on a combination of their profile, their history and the company's changing strategies and tactics for growing revenue or managing customer satisfaction.

Content Presentation and Advertising

As discussed earlier, the Internet standard is for content presentation in conjunction with process management. The content can be stored in a range of repository or database formats. Increasingly, people are moving to rule management technology to coordinate the flexible presentation of content often stored in multiple locations. Portal framework software and dedicated Advertising Server software can be combined with rules technology to provide precise display and tracking of advertising "displays and clicks".

Advertising Scheduling

While shop floor scheduling is an integral part of manufacturing systems and route scheduling is an integral part of distribution management applications, there are few standardized approaches to the scheduling of advertising. As it turns out, whether you are planning for newspaper, television or radio ad placement, there are rules that govern contract compliance, rules that deliver basic equity among advertisers, and rules that avoid unnecessary and silly mistakes. Often there is also a need for rules to address contingency plans when fast breaking major news takes more space or time than normal. For broadcasters who cover live events that do not always end at predictable times, additional rules are required. Rule management technology is helping.

Account Management & Customer Service

CRM applications (connected or mobile) where the user is a company employee or customer require the provision of account history. The demand for this is growing rapidly. People increasingly expect to see appropriate account history with appropriate security in all of the applications they use. Advanced customer self-service and employee CRM applications are already providing this information, generally pulling it from multiple databases. Rule management technology allows CRM applications to take better advantage of a unified view of the customer across billing accounts and across interaction history. Enterprise consistency and flexibility of display are critical in these areas.

Call Routing

This process area is similar to lead assignment. CRM applications have good, basic call routing capabilities. But they are generally table driven. What happens when you want to be more sophisticated? What happens when you want to add a new routing variable? With high-end call center solutions, routing algorithms may need to consider IVR inputs, customer history, time zones, product expertise, load balancing, customer ownership and a range of other factors. In these situations, CRM applications can often benefit from the supplemental use of rule management technology.

Lead Management

As in the case of product pricing & discounting, CRM applications support lead assignment based on one or more database tables. For simple, stable lead assignment rules, this is often completely sufficient. However, there are situations where the conditional logic and exceptions and/or the rate of change can argue for the use of rule management technology. If leads are being shared with channel partners based on product line and customer history, or if leads are being assigned based on geography, product line, opportunity size and customer history, traditional database tables may present real limitations. Adding an external rule-based lead assignment service to a CRM application is appropriate in these cases.

Healthcare Delivery

Healthcare delivery involves many processes. Given the multitude of payers in the United States and the wide range of payment terms, patient registration is different from validation of clinical treatment, and both are different from payer invoicing. As the Internet changes everything, healthcare delivery will inevitably change. Cost pressures are enormous, and the information explosion is mind numbing. The number of new drugs invented each year presents a memory challenge for all health care professionals. Any service delivery that can be safely provided on a self-service basis or with the assistance of a trained nurse instead of a doctor is potentially valuable from both an economic and a consumer convenience perspective. Any quick data entry or code/drug/clinical pathway look-up tools that are mobile and easy to use while delivering service are a great benefit in terms of both economics and quality of care. Rule engines can support health care delivery in many ways. Healthcare is also

an area where consistency across applications is of paramount importance.

Engineering Design

Engineers work with a lot of variables. Some variables are associated with specific components or parts. Others are associated with sub-assemblies or assemblies. But the web of interdependencies between these variables is enormous. A change in one design parameter at a part, component or sub-assembly level might require hundreds of branching tests and validations, performed in a very particular order. Cost-oriented rules might need to be balanced against other engineering requirements. Engineers work with CAD systems, PDM applications, ERP Bills of Material management application modules and internal engineering databases. Rule management technology is a natural for assisting in complex design process.

Supply Chain and Transportation Management

Logisticians attempt to plan sourcing based on options, costs, risks and preferences. They also attempt to plan delivery based on transportation options, level of risk aversion, coordination requirements, costs and preferences. Although linear programming can be helpful in some cases, and it is theoretically possible to create an extremely large set of constraint statements that would algebraically model the optimizations needed, real world problems can be solved in a more human and ultimately more efficient way via the use of declarative rule technology. With rule management technology, you create a sequence of discrete rule services that make the best decision at each point in the process with the information available. If an exception condition comes up, rule services can be invoked which will perform appropriate contingency planning. With the reusability inherent in rule management technology, running a question through a logic sequence a second time is extremely low cost. Rule management technology can also help supply chain planning applications with marketplace/exchange/RFQ rules to support procurement processes. Transportation assessments and planning decisions that rule management technology supports can assist both supply-side planning and sell-side customer service.

Equipment and Network Maintenance

In the equipment and network maintenance arena, we have another area where existing applications sometimes do the job and sometimes do not. Some of them work well for scheduled maintenance, and some can apply diagnostics to a problem or even invoke pre-built case-based reasoning models. More often than not, however, they are unable to apply a set of rules to a specific symptom or condition and execute a specific action or set of actions as a result. Another area of interest is the area of "on-board diagnostics." It is sometimes desirable to provide low-cost rule services in an automated fashion. Modern rule management technology can launch tests, review results and take actions in a very efficient manner.

In the network management arena, the history is primarily a custom application history. There are many different types of rule services that can be helpful in network management. Certain problems require rule engines with optimization functions, while others require the sequenced application of declarative rules. Some problems are business transaction oriented, such as calling card fraud detection, while others are network management related, involving the assessment of data from monitors, and the setting of alarms and escalations. In these areas, the buyer needs to be careful to pick the right tool for the job at hand. Specific rule technology systems always have relative strengths and weaknesses.

Training, Human Resource and Student Management

Many applications exist in the areas of training, coaching, registration, benefits administration, etc. The applications developed to manage large student populations have many similarities to the ones developed to manage employee benefits, training,

travel requests, reimbursable expenses and vacation scheduling. Colleges and universities have rules that govern access to over-subscribed classes, degree requirements, loan repayments, student employment opportunities, etc. In many cases, getting all of these rules into database tables is impossible. And writing them all in procedural code is an unsatisfactory solution. Rule engines can help.

An area of particular interest is the development of configurable on-line coaching applications. Rule management technology can help determine what coaching is needed, drive interactive dialogs and perform assessments based on real data.

Telecommunication Operations Support Systems

Traditional networks, both voice-optimized and high-speed packet-switched, have employed Operations Support Systems (OSS) as an overall solution for operations, administration, maintenance, and provisioning of network services, front-office billing, and customer care. The co-existence of voice and data services has created "overlays" on top of these existing networks, demanding new functionality in these OSS solutions. The need to provide Service Level Agreements (SLAs) is likewise demanding additional functionality. As a result, there is a growing acceptance of the need for a component-oriented, open, distributed, and easily tailored OSS platform solution that allows for interoperability among services and vendors.

Such an OSS platform must be easy to deploy and manage in distributed environments. It must also allow a services provider to continually offer integrated services to enhance customer management, service management, and network and system management.

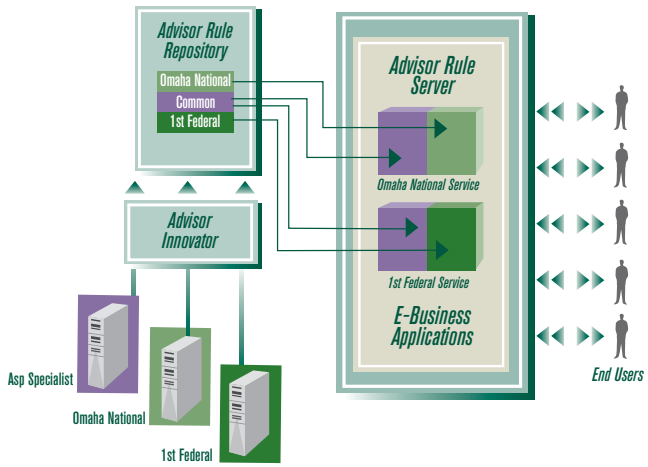
All this creates a requirement to separate business process flow control from functional application flow control which, in turn, gives service providers the ability to flexibly tailor and differentiate their business processes while still sharing the same functional data model. Blaze Advisor's rule management technology is a natural fit for these OSS solutions. The functional data model in each OSS layer is easily accessed from Advisor rules using Blaze Advisor's Business Object Model Adapters (BOMA). Service-provider business people can then use Advisor rules to develop and evolve applications as new business practices emerge. This dramatically reduces the lifecycle cost of ownership for new services while leveraging the investment in existing ones.

Customer management in such an OSS platform needs to handle traditional customer relationship management functions such as flexible invoicing, bill representation and payment for different types of services. This must support a wide range of services (DSL, IP, VoIP, WAP etc.) provided to many different customer types (individual, business, ASP etc.). Blaze Advisor's BOMA can access user information and order information, as well as derive billing information based on service types and service cost. Service management needs to handle usage-based, event-based, and policy-based service provisioning from heterogeneous downstream services originated from voice and data services transported over ATM and frame relay networks. Network and system management needs to map policy-based SLA s to Quality of Service (QoS) policies. Blaze Advisor's rule engine helps to route service calls depending on the service type.

The Special Needs of Application Service Providers (ASPs)

One interesting by-product of the Internet revolution is the emergence of Application Service Providers. For many organizations, there are too many new technologies to learn, too many applications to develop and/or configure, and too many to deploy and support. More and more, companies are taking the short cut of outsourcing specific application services. These business arrangements can involve charges that cover hardware and network usage as well as application rent and application management services. There are two types of software ASPs

(not including ASPs who are only in the hosting business) who are servicing this growing market. The first type is an application software company that has determined it can gain and keep more customers by hosting their customers' use of their application on an in-house basis. The second and perhaps larger category is made up of large businesses that have developed a significant custom application to compete in an area of business activity. This type sees revenue, market share and market control benefits from letting other, generally smaller companies in their industry use this same application software they use. This is an increasingly common way to form tight channel networks and to reach specific geographic or demographic markets that might be unavailable to the large company.
For this to work out in practice, software ASPs need to provide configurability for each client. Sometimes the client-specific



Blaze Advisor rule management technology allows ASPs to develop client-specific rule services without creating completely customized application structures for each client. Omaha National and 1st Federal have autonomous control over a portion of rule authoring and maintenance, while fundamental rules common to banking or based on the ASPs preferences and policies are kept centrally by the ASP. In this case, the ASP could be a large bank or an ISV leasing use of a hosted web application to multiple client banks.

rules are well supported by dedicated database tables, but often these tables can't provide all of the required flexibility in terms of rule conditions, database look-ups, evaluations and business actions. Rule management technology allows a software developer to build an application that uses external application services to support the needs of both the application developers and their clients. They include set, centrally administered business rules defined by the application developer using their domain expertise, as well as a client-specific component with client-specific process and personalization rules and client-specific rule maintenance applications. This modularity allows the ASP to provide extremely tailored service to a wide range of clients while maximizing reuse, standardization and control.

Only rules management technology gives an ASP the flexibility to create truly configurable business services for each client. Giving each client configurable database look-ups, configurable rules and configurable content display where appropriate is the cutting edge of customer service in the ASP world today.

There are three keys to success in the ASP model. The first is to give each client the ability to maintain the rules that affect their version of the application with an easy to use application and the allowed value controls necessary to ensure safe maintenance of their tailored application service. The second is to give the ASP the ability to quickly add a new rule service for all clients with a client-specific maintenance screen available for each. And the third is to give the ASP the ability to add a new client and easily create rule maintenance application pages for each client-specific rule service component. This level of infrastructure will be required for many ASPs in the future. Blaze Advisor has it now.

The Role of Rule Management Technology in 21st Century Application Architectures

Rule engines are destined to become a major component in the application architectures of many organizations over the next five years. Many of the core application development effi-

ciencies and industry or process-specific requirements that are driving the increased adoption of this technology have been touched upon earlier in this paper. It is appropriate at this point, however, to reflect on the special impact of rules management technology on CRM and the growth of mobile service applications.

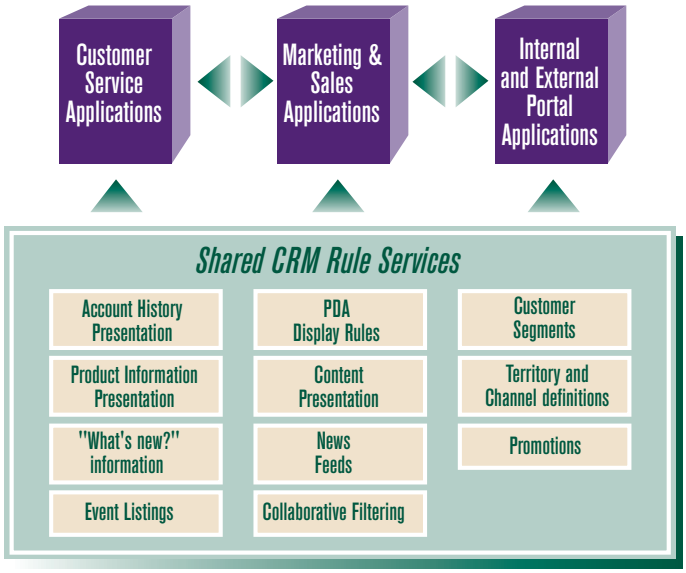
Support of Customer Relationship Management (CRM)

Imagine a world where you could design and build a database and three customer self-service applications – a connected Web application, a mobile application (Palm, WindowsCE and mobile phone using WAP) and an IVR phone application – that share a set of rule services. Some are used by multiple applications, some by just one – but all of the business logic is centrally developed using rule management technology. These rule services evaluate customer history in context, segment customers, present account information, present Web content and useful Web links. The services also execute decision-making processes and business transactions based on a sequence of rule evaluations that can launch all of the necessary database look-ups and calculations. Rule updates are put into effect on a scheduled basis, updating the operation of the client applications without any downtime. Business domain experts can easily and safely update the rules that change frequently and put changes into effect immediately or after approval. Rules that vary by country, state, division and product line can be modified on a decentralized basis by the appropriate business people, using intuitive Web-based rule maintenance applications with appropriate access controls.

It means delivering superior customer service in the very near future. Rules management technology can provide the segmentation, personalization and business rules that allow all customer-facing applications to provide better service with enterprise consistency. This is one example of how rules management technology is revolutionary.

Support for the Mobile Revolution

Most usage of rules management technology to date has been fundamentally "enterprise-centric". In other words, the applications being built were focused on business processes that enforced enterprise goals, policies and procedures. They also required users to be connected to the Internet, either at the office or via a standard phone line. But now an entirely new class of "user-centric", mobile application is beginning to be built. While many continue to continue to enforce business



objectives and rules, they are focused on taking advantage of the paradigm shift to multi-channel communication. These applications focus on personalization in new ways. They require high-scalability and advanced payment technologies as well as the ability to send alerts, display content on multiple devices and enforce rules. Most of all, they require giving the user a far greater degree of control over what services they receive when and where. Blaze Advisor rules management technology is a critical enabling technology for the successful design and deployment of user-centric mobile service applications.

Critical Success Factors associated with the Adoption of Rule Management Technology

There are three key success factors that contribute to making you successful in adopting rules management technology:

1. **Object Modeling Sophistication** – Rule Management technology changes the way you think about object modeling. Not only can you take advantage of data in many different locations, you can also extend existing classes and define dynamic classes that can generate temporary objects for use by the rule execution process. Taking maximum advantage of these possibilties requires thinking in new ways.

2. **Rule Service Design Experience** – Rule services can be designed in different ways. Some designs maximize reusability. Some designs maximize performance. Some designs maximize controlled rule maintenance by multiple groups and individuals. What is best for a given project is always to some degree a balancing act. Only experience and study will allow you to take maximum advantage of the technology.

3. **Knowledge of your Deployment Environment** – Rule services are generally deployed into application server environments. Blaze Advisor's Quick Deployment Wizards will certainly help you deploy rule services into BEA, IBM, Sun and Brokat Technologies environments, but you must still know your own environment.

Performance Considerations and Platform Support

Today's enterprise solutions must meet advanced scalability and performance requirements as well as meeting the standard requirements necessary for interoperability with leading platforms and open technologies.

Scalability

With many customers deploying rules-based processes in high volume e-business apps such as personalized portals, on-line stock trading, consumer lending, insurance sales and call center customer support centers, it is vital that a rules-based approach can scale.

Blaze Advisor's approach to scalability is threefold:

- Design the rule engine to be as fast and lightweight as possible thereby giving the operating system / Java Virtual Machine / application server more headroom. Having multiple service agents for a rule service is fundamental to provide this required level of scalability.

- Have shared rule networks (rule bases). Unlike some other implementations, the Advisor Rule Server has only a single copy of the rule base in virtual memory. All active rule agents share this single copy. By using such an approach, memory footprint is dramatically reduced and the Java Virtual Machine is considerably less likely to page swap. Tests at HNC have shown that hundreds of concurrent, active rule agent sessions can run in less than 10 MB of virtual memory.

- Be a "good citizen" in all of the leading application server environments. The philosophy is to leverage the tens of millions of dollars invested by other vendors in scalable, fault tolerant application servers. For us, this includes testing on and support for operations with products such as IBM WebSphere, BEA WebLogic, Microsoft Transaction Server, Sun iPlanet, and others. Advisor Rule Services can be deployed as well-behaved stateless/stateful session beans (EJB and J2EE), COM components (Microsoft), servlet or CORBA services.

And because rules can be changed while the Rule Server is processing active business events, Advisor also delivers uninterrupted service. New business events use idle agents associated with the "new" rule base, while the active sessions are left to

complete execution based on the "old" rule base. After all in-flight sessions using the old rulebase are completed, the old rule base is purged from memory. Note that sessions may be long-lived across multiple interactions with the server.

Performance

Especially in batch environments, performance requirements can be very high. This has been and continues to be a priority for Blaze Advisor engineering. Two specific features are noteworthy in accelerating runtime performance:

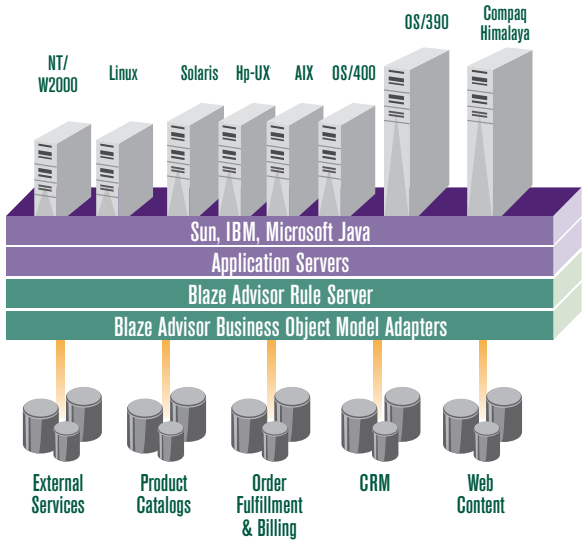
- Use of the Rete network and algorithm as the data structure and execution engine has been shown to be the fastest mechanism for quickly identifying those rules with "true" premises out of thousands of rules. Blaze Advisor has added various optimizations to Rete over the years to increase throughput for the types of business rules applications used by our customers. One optimization of note is the use of rulesets organized by ruleflow step. This limits the rule consideration horizon to only those rules in the current rule set.

- Demand-driven property fetches. Advisor's rule engine only accesses the property values of your business objects when it needs them. So, as the rules are evaluated, only those properties needed to actually complete the business event are fetched. In some cases, these properties might involve accessing a remote object that is relatively expensive to retrieve so every fetch that can be avoided is helpful to overall performance. In other scenarios, by using "whenever xx is needed" type rules, explicit control can be placed into the rule base to decide when to retrieve remote data (such as by making an SQL call).

In general, the Rete network is so efficient that large machines can easily process over a thousand client sessions per second through a multi-step rule service. Performance issues are primarily a function of the quantity and complexity of data assembly prior to running a rule service and the number of data assemblies or updates associated with a complete business evaluation and decision process.

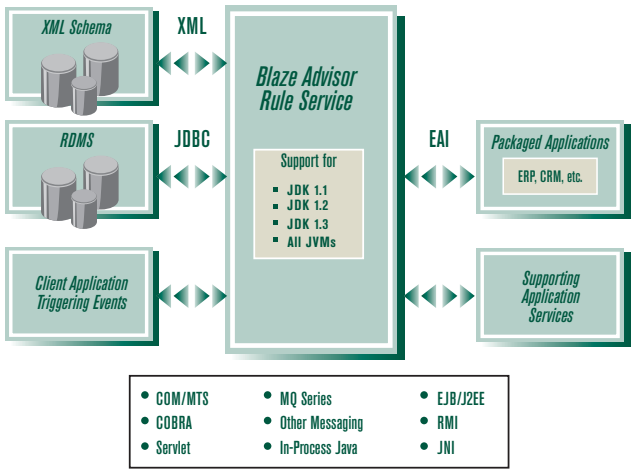
Rule Services and Distributed Computing Environments

The Rule Server component runs on a wide variety of Java virtual machines as shown in the figure below. So, your basic computing infrastructure is probably already part of the supported suite of deployment environments.



Secondly, Advisor takes full advantage of today's distributed computing environments. An Advisor-based rule service can provide rules-based processing against either local or remote objects. Remote object access is done intelligently to minimize network round trips.

Information from restricted access applications such as back end ERP systems (accessible through EAI software such as provided by IBM MQSeries, Java1 and others) can be com-



bined with enterprise database data, XML documents and transient, session-based data (click stream).

Because Advisor is built with a Business Object Model Adapter (BOMA) layer, the rulebase is cleanly separated from where the actual objects reside. Through the various concrete implementations with which Blaze Advisor ships (COM, Java, JDBC and XML) or through the BOMA Kit (for other object models such as messaging), the Advisor rule authoring environment is provided with the structure (schema) of your enterprise business objects. The Blaze runtime environment has direct high performance access to all properties of your enterprise business objects as well as your methods, if any.

So, whether you have a distributed COM, EJB, CORBA, RMI or database environment, the BOMA feature makes this corporate data available to your rule service. Put another way, anything you could do with procedural code in terms of accessing remote objects is provided through the BOMA architecture.

About HNC

HNC Software Inc. (Nasdaq: HNCS) is a leading provider of Customer Insight software that enables companies to acquire, manage and retain customers. HNC's decision management and customer analytics technology analyze bothstructured and unstructured data so companies can derive value from all information. The company's sophisticated software is used in the telecommunications, financial services, insurance and e-commerce industries.

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