TechUpdate
The Enabling Technology of Business Rules Engines

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September, 2006   Version 3.0

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Executive Summary

Growing operational complexity, ever increasing data, and the need for faster decision cycles, make greater demands on our organizations to effectively and efficiently achieve operational transformation. To date, Business Intelligence (BI) applications have relied on subject matter experts. Their vast experience has taught them to spot patterns in the complexity and associate existing strategies to address those patterns. Nevertheless, as critical as these experts are for each of our organizations, they also represent our Achilles heel. The simple truth is that these subject matter experts are rare. They cannot be at all places, addressing all problems. They cannot be monitoring our organization 7 by 24, nor can they facilitate real-time analytics.

The relationship between the analyst and the BI environment must be the focus of BI architects going forward. It is the responsibility of the Chief BI Architect to lobby for and establish an intelligent service layer in the BI infrastructure with technology such as Business Rules Engines (BRE).

Only Business Rules Engines are specifically designed to:

- Identify insight and immediately act on it
- Address real-time, in-line processing
- Encapsulate subject matter expertise for the purpose of consistent, automated decision support

Three things will continue to build momentum as the BRE market matures over the next 24 months. First, leading RDBMS and BI vendors will continue to expand the role of BRE technology in their solutions. Secondly, the pure play BRE vendors will maintain their lead by embracing more advanced analytics. And, finally, consolidation will occur among BRE competitors.
Operational Transformation

For years, organizations have invested in data warehouse and BI environments in search of actionable information and insight—the promise of any BI system. But this promise could never be fully realized simply because BI, in and of itself, is never enough given the traditional technologies implemented and approaches taken. To make this point, let’s assume you establish a sufficiently robust BI platform to glean insight from the enterprise data. What next? An analyst, using your BI environment, has discovered a trend that requires adjustment to the sales forecast, inventory levels, or financial strategy, what is the process to ensure that insight is effectively applied to the organization? All too often, there is no plan or formal process. We invest millions of dollars in BI solutions in our quest for actionable insight, but do little or nothing to establish mechanisms to ensure that insight is applied to improve operations. Refer to Figure 1.

Figure 1. BI and Operational Transformation

What is often missing in BI applications is a formal set of processes and solutions whose purpose is to take actionable insight and drive it back into the enterprise, literally act on that insight, transforming operations. Exacerbating the situation is that

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traditional BI implementations focus on delivering information to an analyst. It is the responsibility of the analyst to identify actionable insight from the information provided and then decide what must be done to operations to improve performance. This process eliminates any possibility of achieving competitive advantage by driving actionable insight back into operations, transforming operations in real-time or on-demand.

**From Data to Action**

Business intelligence (BI) improves corporate performance in any information-intensive industry. Most companies have the raw data and the people-knowledge BI requires. The challenge is to extract and exploit this data to transform tactical operations---improving our business performance.

But many companies take advantage of only a small fraction of their data for strategic analysis, let alone tactical or operational applications. Moreover, the BI environments built are pre-constrained to only deliver information at best. The traditional BI system depends on an analyst to identify the action necessary from the information provided, and then act on that information.

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While this situation may be sufficient for some BI requirements and applications, it is entirely ineffective for many of today’s requirements, specifically, the need for real-time and on-demand operational transformation.

**Enabling Operational Transformation**

There are few technologies in the BI tool chest that provide a means to enable Operational Transformation in our organization as well as the Business Rules Engine (BRE). As shown in Figure 2, BRE technology can traverse your enterprise, interacting with disparate data sources and applications, executing the decision-making process.

There are three areas where BREs excel, well beyond the typical BI technology pitched as solutions for organizations around the world. Table 1 outlines each.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Typical BI Technology</th>
<th>Business Rules Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fulfilling the promise of BI</td>
<td>Provides no means for acting on found insight</td>
<td>Can identify insight and immediately act on it</td>
</tr>
<tr>
<td>True real-time analytics</td>
<td>Born from static, batch architecture requirements</td>
<td>Designed and built for real-time, in-line processing</td>
</tr>
<tr>
<td>Optimizing decision support</td>
<td>Affords only a means to interrogate data domains</td>
<td>Designed to encapsulate subject matter expertise for the purpose of in-line, automated decision support</td>
</tr>
</tbody>
</table>
BRE Technology

This section identifies those core functions that best represent the BRE modern technology available. Moreover, the content explores some of the leading competitors in the BRE space so that readers can gain a sense of how each stacks up against the other.

Core BRE Functionality

There are at least eleven core functions that best define modern BRE technology. For brevity, they are outlined in Table 2 below.

Table 2. Core BRE Functionality

<table>
<thead>
<tr>
<th>Functionality</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-level Rules Language</td>
<td>A language for declaring rules that contains high level constructs such as “If at least” and the ability to manage patterns, for example, “Elderly male is any person where….”</td>
</tr>
<tr>
<td>Forward Chaining (Inference)</td>
<td>Built-in algorithm for firing (executing) and refiring rules as data is changed.</td>
</tr>
<tr>
<td>Backward Chaining</td>
<td>Built-in algorithm for goal-seeking behavior.</td>
</tr>
<tr>
<td>Sequential/Explicit Execution</td>
<td>Ability to execute rules in a sequential or explicit order where chaining is not required.</td>
</tr>
<tr>
<td>Repository</td>
<td>A storage mechanism that supports versioning, reuse, release management, audit trails, etc.</td>
</tr>
<tr>
<td>Data Interoperability</td>
<td>Deploys as a 100% Java, .NET, or COBOL component.</td>
</tr>
<tr>
<td>Service Oriented Architecture</td>
<td>Deploys as a web service for use in an SOA.</td>
</tr>
<tr>
<td>BPM Functionality</td>
<td>Includes workflow and process management, work list, management capabilities.</td>
</tr>
<tr>
<td>BPM Integration</td>
<td>Integrates with third-party business process management products.</td>
</tr>
</tbody>
</table>

Segments of BRE Technologies

There are many players in the BRE marketplace. This creates a dynamic and rapidly changing environment where competitors are evolving quickly. Consequently, attempting to discern the variations of BRE technologies is problematic. The challenge is made more difficult because the implementation of business rule-centric technology can be fragmented over a suite of product offerings, each rule implementation playing a unique role in a particular application.

Some industry analytics are attempting to divide the BRE space between those products that provide advanced functionality like Inference (Forward Chaining) and those who simply translate explicit rules. Then there are those who see the market in terms of implementation techniques, for example:
**Business Rules Management Systems:** These types of rules systems are considered the best-of-class. They provide features to create, maintain, store, and execute complex decision-making logic. The core features of BRMS products are outlined in Table 2.

**Table-driven Systems:** This technique stores explicit rules in tables and calls on the rules using either relational database languages such as PL/SQL or external high-level languages. The core limitation of this approach is scalability. Since rules are explicit, they are often simple. And, because the rules are stored in tables, extraction and execution will constrain performance.

**High-level Programming Languages:** Of course, you always have the option of programming your own business rules system. Aside from the challenge associated with all custom programming efforts, programming for decision optimization does introduce new issues that are not readily handled in high-level programming languages. For example, BRMS environments provide a rules language specifically designed to treat each rule as independent logic that is precompiled into a decision structure that organizes condition combinations for fast determination of all rules affected by a given set of conditions. Therefore, a condition state is only calculated once. That does not mean a robust development effort with sufficient resources cannot create something similar, but you have to ask yourself if purchasing a solution might not be more cost effective.

**Code Generators:** Rules-based decision logic is sometimes implemented using a high-level program code generator. The approach provides a means to define logic for decision-making steps and then translate that logic into a programming language which, in turn, is compiled and executed. The advantage of this type of approach is that it simplifies the programming effort. However, the limitations of this approach are those inherited from the high-level programming language approach, which is further constrained by the effectiveness and efficiency of the code generator.

**BRE in Terms of RDBMS and Pure Play Vendors**

Since this paper is focused on those of us in the Business Intelligence space, this author will divide the BRE technology into what is believed to be the most important point for architects; that being the difference between pure play vendors and leading Relational Database Management Systems (RDBMS) vendors. Using the core functionality defined in Table 2, a product comparison of four vendors, two pure play and two RDBMS, are compared in Table 3.

As with many aspects of the BI space, the best technology is found with the pure play vendors. For BRE this is no different. Fair Isaac’s Blaze Advisor is considered by many to be the best-of-breed technology. It represents the top end of rules technology and the target set of functionality by which all others are measured. However, even as good as the pure play offerings are, the best total cost of ownership argument in the BI space, will inevitably be associated with the leading RDBMS vendors who continue to incorporate functionality into the enterprise database architecture itself.
But leading RDBMS players are not the only ones in the BI space attempting to expand their BI platform by extending the availability of BRE technology, so too are other BI vendors, such as Hyperion. The latest release of Hyperion System 9 is a prime example. This release has incorporated BRE technology to facilitate their product position for Business Performance Management.

Table 3 – Comparative BRE Functionality

<table>
<thead>
<tr>
<th>Feature</th>
<th>Leading RDBMS Vendors</th>
<th>Pure Play Vendors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oracle Fusion</td>
<td>IBM WebSphere</td>
</tr>
<tr>
<td>High Level rules language</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Forward chaining (Inference)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Backward chaining</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sequential / Explicit execution</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Repository</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Java Platform</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>.NET Platform</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COBOL Platform</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOA Support</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>BPM functionality</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>BPM Integrations</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
The Bright Future of BRE

Today’s business climate requires a BI environment that evolves beyond the implementation of traditional data warehousing tools and techniques. A fusion of traditional and advanced technologies is necessary to support a broad analytical landscape that supports the full scope of decision-making processes including strategic, tactical, and operational.

Moreover, the expanded BI environment must improve the knowledge and performance of the enterprise as a whole, ensuring that actions taken, as a result of analysis conducted, are fed back into the environment, literally in real-time or at least on-demand. Only then can the modern organization hope to remain competitive. Only then can it achieve operational transformation.

Three things will continue to build momentum as the BRE market matures over the next 24 months. First, leading RDBMS and BI vendors will continue to expand the role of BRE technology in their solutions. Secondly, the pure play BRE vendors will maintain their lead by embracing more advanced analytics. And, finally, consolidation will occur among BRE competitors.

It is yet unclear whether leading RDBMS will take over this space as they have done with the Extraction, Transformation, and Loading (ETL) space, or pure play vendors will continue their dominance. But one thing is absolutely certain: A BI platform must include BRE technology to address the scope of today’s requirements.
Appendix A – Decision Types

When the BI community speaks about supporting better business decisions, it traditionally does so from the perspective of strategic decision-making. However, as the BI space matures in terms of technique and technology (and user demands grow), BI continues to evolve. Today, there is significant attention and interest in supporting tactical decision-making as well. But strategic and tactical are not the only types of decisions made in an organization. Many argue that there’s a third type: operational decision-making. Table 3 shows definitions and examples for the three categories.

The end game for BI isn't simply exposing actionable information and insight. It's also to ensure that action is taken to improve business performance. The challenge for BI is not only what information is combined with what knowledge, but also how to ensure action.

Table 3. Decision Categories.

<table>
<thead>
<tr>
<th>Decision Category</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic</td>
<td>Broad decisions affecting the entire organization (for example, mergers and acquisitions, market expansion, and new product development)</td>
</tr>
<tr>
<td>Tactical</td>
<td>Managed determination of process, customers, products, and so on (for example, defining the acceptable level of risk for new applicants)</td>
</tr>
<tr>
<td>Operational</td>
<td>Transactional decisions (for example, approving or declining a specific application, detecting fraud, and so on)</td>
</tr>
</tbody>
</table>

For strategic and tactical decisions, any action taken requires human intervention. Curiously, there may be considerably less effort on the BI team to service these types of decisions. The BI team may need to build a data store and install tools that allow users to perform their own research for insight. An OLAP cube, for example, is implemented for a subject matter expert to interrogate data. The BI team often focuses only on providing the cube and tools and the user is tasked with finding any actionable insight. Making these types of decisions less difficult to implement than projects focused on operational decisions. Operational decisions can be, and often are, automated. Figure 3 shows the direct relationship between the decision category and the amount of human intervention required. Since they are often automated, considerably more research and implementation work rests on the shoulders of the BI team.

Strategic decisions (such as those regarding expansion) have broad implications for the direction of the organization as a whole. Answers to these types of questions are rarely derived from a purely automated environment. Even when building simulation models, subject matter experts must still evaluate the results and formalize actions taken. Tactical decisions are focused on managing processes, such as evaluating and establishing the level of risk the organization is willing to assume for specific loan products, for example, mortgages. Operational decisions, however, are the most
fundamental. They address individual transactions (such as whether a loan is approved or not). And, they likely represent the highest number of decisions made on a day-to-day basis. It's precisely for that reason that operational decision-making can and should be targeted for automation.

Figure 3. Decisions and Automation Matrix

In order to provide BI value, business architects must understand the kinds of decisions made in organizations, including strategic, tactical, and operational. Each category provides clues as to the type of action process that's feasible. Strategic and tactical decisions are often best suited with some human intervention. Once a decision has been made, it's possible that the action process is a composite of several disparate adjustments to operations. On the other hand, operational decisions can often be fully automated and the subsequent actions a part of an inline process.
Appendix B – Decision-making Process

It may be a shock to some readers that not all user communities follow the same process or have the same requirements to make decisions. Architects must include defining the process for each BI requirement being designed and implemented. To that end, BI architects must answer two questions:

**What is the decision-making process?** The notion of helping organizations make better decisions and become more efficient is hardly new. To effectively implement systems that support the decision-making dictates that you understand the process.

**How can the BI environment make that process better?** Once the BI architect understands the decision-making process, it is important to answer two subordinate questions: What are the most predominant decision-making process patterns used in my organization? And, what technologies can I implement to support those patterns?

BI architects can use a growing body of research that provides formal models to understand the decision process. For the purpose of this paper, this author has chosen Rasmussen’s Decision Ladder. Rasmussen defines eight steps to the decision-making process as illustrated in Figure 4. Assuming that these eight steps accurately summarize the decision process, then BI architects must ask, “How much of this process can be addressed by the BI infrastructure we implement for our organizations?”
Figure 5. BI and the Decision Process

For example, the left diagram in Figure 5 places the majority of the decision process to human intervention. The BI applications role in this situation is limited to the more traditional role of activating the decision process simply by detecting an event. Everything else, from identifying the event, predicting and planning the action necessary, and finally executing the chosen plan is all done by the analyst. Although this balance may be effective in some cases, it simply does not scale. Increases in data volume will slow down an analyst’s ability to derive insight. Moreover, relying wholly on the analysts for the decision process makes a real-time solution impossible.

The right diagram in Figure 5, however, relies more on automation for the decision process, especially for those decisions that are repetitive. This scenario affords greater scalability. Whether the data volume is large, or there is a real-time requirement, automating the decision cycle provides many benefits, including:

- Decision Consistency
- Real-time Capability
- Addresses Operational Decisions
- 7x24 Capability