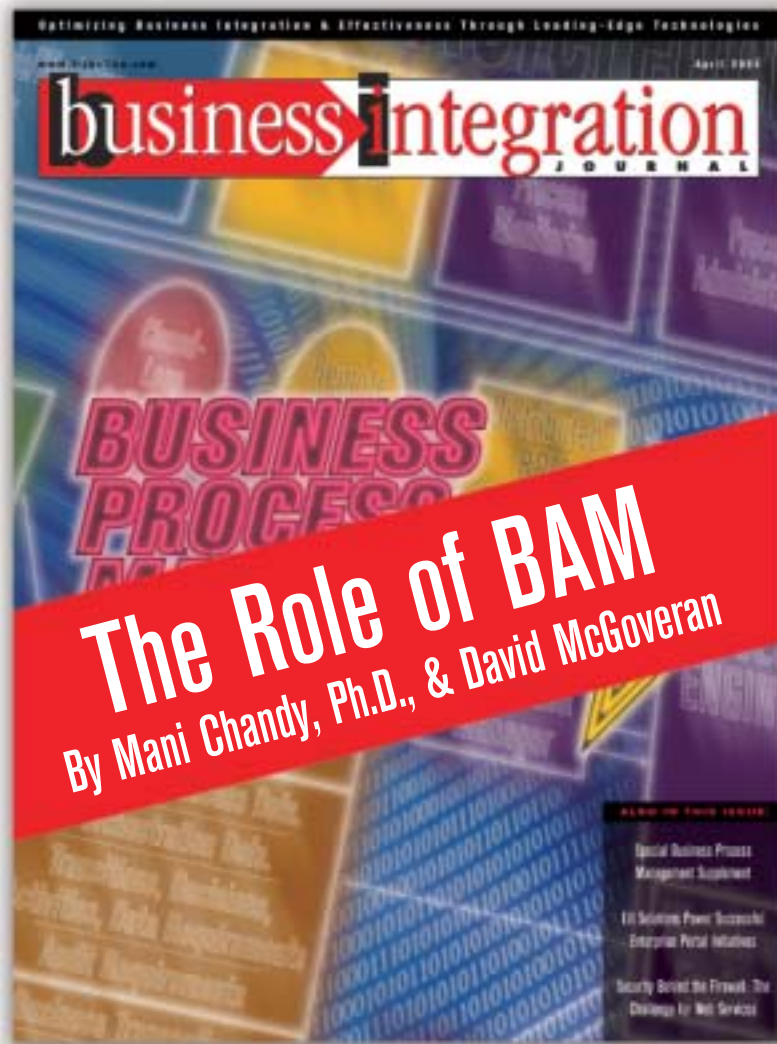


This article appeared in the
April 2004 issue of

business integration
JOURNAL



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The relationship between business activity monitoring (BAM) and business process management (BPM) is an intimate one. Identifying the value and proper use of these technologies can be difficult, given the buzz about them and the variety of features offered. We discuss features of BAM and BPM, identify commonalities and differences, evaluate target applications for each technology, and explore the opportunity available to your business from integrating these technologies.

Human activities can be placed in a spectrum based on the sophistication of reasoning that we employ. These activities may range from breathing, walking, driving, responding to threats and opportunities, and developing business plans. Activities that use more sophisticated reasoning also have larger fields of vision. When you walk, you need only look a few feet around you; whereas when you drive, you need to be aware of a much larger environment. When you're developing a business plan, you need to be aware of global situations.

Information technologies leverage human capabilities, and they've done so historically by moving up the spectrum from capabilities that require less sophisticated reasoning and limited fields of view to more sophisticated reasoning and larger fields of view. The entire sweep of IT history demonstrates this; from the era of punched cards and automatic data processing, to simple business process automation (analogous to walking), to EAI and workflow (analogous to driving), and currently moving into the era of BPM, BAM, and the real-time enterprise (analogous to a worldwide military command and control system).

Eventually, IT will move to the adaptive, learning enterprise. While the initial focus of BPM's predecessors (such as workflow management) was on automating important but well-understood and repetitive activities, the focus of BPM is on enabling rapid, efficient, and measured change to all business activities that can be understood as part of a business process. A focus of BAM is on leveraging human capabilities further up the spectrum: rapid, appropriate response to threats and opportunities.

Process control has been used in manufacturing for decades. The chemical industry has gained a great deal of experience from chemical plants that have operated efficiently with a high degree of automation. As costs of services rise, businesses are mapping from engineering process control concepts to BPM. Many of the features of BPM have analogs in process control. Examples include automation, decision support systems and rules engines, monitoring tools and displays.

BPM technologies manage business processes, including their design, analysis, execution, measurement, and modification. BPM helps automate process flow, relieving human decision makers from having to make repetitive decisions that can be encoded within an algorithm. BPM infrastructures monitor and record the flow of documents >

THE ROLE OF BAM

By **Mani Chandy, Ph.D., &
David McGoveran**

and actions; this record can help in identifying transient problems such as a lost insurance application and, equally important, help in identifying systemic logistic problems such as poor response times in some departments. Business processes can be automated across multiple systems and a variety of applications, so BPM technology can also be viewed as a natural extension of EAI. Dashboards display data and key performance indicators related to business processes monitored by BPM infrastructures.

In our analogy of a hierarchy of human activities, when we start to learn to drive, we use our brains at every point and drive slowly. Later, the activity becomes increasingly instinctive, following repeated patterns, and we drive faster. BPM infrastructures help in reducing the amount of human participation in repeatable business processes, freeing the brainpower of your employees to more creative tasks.

BPM doesn't stop there. Its real value comes from its ability to enable rapid, knowledge-driven change of the business process, whether to enable higher levels of efficiency (business process redesign), create new business processes to address new opportunities (business process creation and innovation), or to realign business processes with strategic business objectives. This is analogous to enabling the driver to choose better routes that will avoid traffic problems, save time, or increase fuel efficiency, or to drive to entirely new places.

BAM has many of the same technological ancestors as BPM. In addition, BAM's technological forbears include business intelligence (BI), autonomic control of technical systems, such as information systems and manufacturing, and military command-and-control with its emphasis on responding to (possibly unexpected) threats and opportunities within time windows. BAM emphasizes detecting critical situations and responding within time windows. The main features of a BAM infrastructure are sense-analyze-respond, coupled with tools for monitoring, display, design, and deployment.

Though the ancestries of BAM and BPM technologies are slightly different, the boundaries between them are definitely fuzzy. BPM's emphasis on enabling and managing business process change depends on the sense-analyze-respond cycle. It therefore necessarily includes BAM insofar as BAM relates to business processes, comprising activities and decisions that can be monitored and measured.

In our analogy of how IT leverages human capabilities, BAM deals with activities that require sophisticated reasoning and larger fields of vision than most consider appropriate to BPM. When we detect threats to the success of a business trip to several countries, our "fields of vision" include weather at these countries, terrorist threats, delays in flights, and possible changes in hotel accommodations. The reasoning we use is more sophisticated than the reasoning we employ to drive.

If one accepts the BPM thesis that most business activities occur in the context of some business process, then the objective of monitoring and measuring, correlation and analysis, and response within BPM becomes identical to the objective of BAM. Likewise, the BAM sense-analyze-respond cycle can then be understood as measuring the results of some business process-related activities or event streams, correlating and analyzing those results, and then determining subsequent activities (the response). The BAM response will then include activities within the same business process (i.e., next steps in the flow) as well as possibly triggering events or influencing activities in other business processes. BAM includes the flow control aspects of BPM. Under this interpretation, BPM and BAM technologies merge into a single framework that supports the adaptive learning enterprise.

The difference between BAM and BPM is largely one of focus. BPM treats events in the context of business process, while BAM treats business process in the context of events. In BPM, the focus is on understanding and managing activities and events as being necessarily related to and occurring in the context of a well-understood, repeatable business process. That business process context might be constrained to a particular process instance, the entire history of process instances, or even a group of related business processes. Recent improvements in BPM technology have enhanced representation, control, and incremental change of repeatable business processes, with improvements to the sophistication of monitoring, measurement, analysis, problem determination, and response being perceived in the industry as slightly lower priority.

By contrast with BPM, BAM focuses on real-time understanding of the global state of the extended environment of an enterprise, and managing activities in response to changes in this global state. Specifying repeatable business processes

is less critical for BAM. Primarily because not all business processes are highly repeatable, let alone automated or even documented, it can appear that some events and activities are unrelated to business process. BAM technology improvements have emphasized broadening the range of events that can be sensed and categorized, with sophisticated improvements in analysis and response recommendation or automation being high priority.

BAM emphasizes responding to the extended environment of an enterprise that may include competitors, governmental organizations, and news organizations. Defining schemas for repeatable business processes that span all these institutions in the extended environment is impossible because these institutions (e.g., competitors) may not cooperate in defining repeatable processes.

Both BPM and BAM process events. Events fall into a spectrum ranging from frequent events for which the enterprise has event-handling processes in place to the occurrence of totally unexpected threats or opportunities. An example of an expected event is the completion of each step in processing an insurance claim. The completion event signals readiness of the business process to execute the following steps. An example of an event that's less expected is a delay in the arrival of a critical part that delays shipment of products to critical customers and results in massive performance penalties. An example of an even more unexpected event is the sudden announcement of a competitor's disruptive innovation, or the impact on business continuity of a natural or man-made disaster. Though BPM and BAM will eventually cover the entire spectrum of events, a simplistic differentiation of the current status of BAM and BPM is that BPM focuses on the expected end of the event spectrum while BAM focuses on the unexpected end.

An emphasis on responding to possible surprises implies that a critical feature of BAM is the ability to "fuse" data in databases, message queues and applications with streams of events from within the enterprise and from partners, competitors, customers, the government, and the markets. Eliciting critical information from vast amounts of data is a function of BI in the business world and military intelligence in the military.

The difference between BAM and traditional BI (including enterprise performance management) is one of emphasis. The emphasis in BAM is on

responding to events within time-windows of opportunity. The emphasis in BI is to support humans making sense of large data repositories by analysis and experiments that may take hours or days. The relative importance of time-criticality implies that BI and BAM use somewhat different tools for correlating data (see Figure 1). BAM event-detection tools can be applied to streams of events as they're entered into a repository for later in-depth analysis using BI tools. Though the current emphases are different, we expect algorithms and technologies used in the event detection part of BAM to become integrated with "real-time BI."

The detection of events in the extended enterprise, including partners and competitors, implies that BAM infrastructures include sensors to obtain information from Web services, Websites, file transfer protocol (FTP) sites and stock feeds from outside the enterprise as well as Web services, message queues, databases and application programs from within the enterprise. Sensor technology, generally forming its most general form, is an integral part of BAM. By contrast, BPM technologies deal primarily with sensors in the enterprise. The data streaming from sensors into BAM infrastructures is often heterogeneous and may include numerical data on flows of gas along pipelines, structured data such as purchase orders in XML schemas, semi-structured data such as tables at competitors' Websites, and unstructured data such as news stories.

In most current BPM implementations, the decision about which processing step to execute next is usually made based on relatively local data. The same decision in BAM is made based on relatively global data. Although neither defi-

nitional for BPM nor appropriate to its vision, this distinction is important, given the state of the technology. For example, in a BPM application, when a purchase order arrives at a mail-order retailer's warehouse, a condition is evaluated to determine if the items ordered are all available locally. If the items are available locally, they are shipped out; if not, the next step is executed, which is to determine the optimal locations to obtain these items. By contrast, in a BAM application, the determination of how to respond to a lengthy delay in delivery of a part to a manufacturer is based on:

- Which products are affected by this part
- Which customers are waiting to get the product
- How important these customers are to the enterprise
- The availability, prices and reputations of alternate suppliers of the part
- Evaluation of the option to buy the product from competitors.

The specifications of threats, opportunities and responses change more frequently in BAM applications than specifications of process flow change in BPM applications. Thus, the ability for business users (as opposed to IT users) to change these particular specifications in a running system is, generally, more important in BAM than changing process specifications on-the-fly in BPM applications.

BAM systems help in responding to the unusual and hence they must be able to capture, if not learn, what is "usual." Detecting anomalies requires an estimation of a baseline. The detection of outliers requires estimation of clusters. That's why BAM technology uses time series statistics,

parametric analyses, machine learning, and other areas of information science associated with signal processing, statistics and pattern recognition.

The response part of a BAM sense-and-respond application is usually implemented in some form of BPM infrastructure. At its simplest, the response is generating an alert at a dashboard. More complex responses include initiation of business processes. BAM events can trigger BPM responses, and BAM may fuse streams of events generated by executions of BPM flows to generate complex events.

A BPMS without BAM is merely process automation or process integration. The basis for any management decisions, whether in managing business process change or in managing the business through process, is simply missing. BAM without BPM is a sophisticated sense-analyze-alert engine; with BPM, it's a complete sense-and-respond platform with adaptive potential.

We expect these information technologies to converge into platforms that leverage human activities at the top of the hierarchy of sophisticated reasoning and global fields of view. The vision of a BPMS with integral BAM will help automate repetitive, well-understood business processes, support responses to threats and opportunities, and support enterprise adaptation and enterprise learning. By reducing the amount of attention that must be paid to more mundane processes, business managers and their supporting staff will be able to spend more time on creative activities, which is clearly a sustainable business advantage. **bjj**

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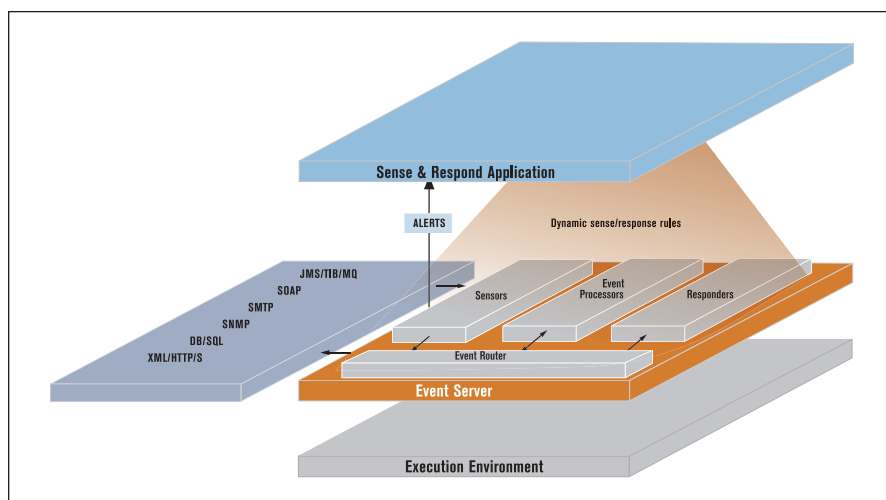


Figure 1: BAM Infrastructure