The Sixth Sense Factor

By Amit Jnagal and Chinku Simon

Proactive information mining can be a novel approach in business

Like most industry verticals, retail and supply chain management rely on the successful execution of complex business processes. Multiple heterogeneous enterprise IT systems including human resources are part of these business processes. The robustness, efficiency and success of these business processes as they get operational day-in/day-out have a bearing on multiple KPIs of the business viz., customer satisfaction, all-round business performance and enterprise agility. Hence it has become increasingly important to monitor the progress of these business processes. Today, businesses come to know of a problem only once something fails in a business process. If a business can avoid an impending problem by taking corrective measures in advance, impact to both end-users as well as the business can be minimized.

In this paper, we will try to present a solution for this new business problem. An SOA based model for monitoring a business process in a heterogeneous product environment is what we discuss in the scope of this paper. This will be based on the principles of minimal invasive surgery.

This paper has been positioned based on the level of maturity of current technologies and business processes and their readiness to move to a new level through innovative ideas.

THE NEW CHALLENGE OF BUSINESS ACTIVITY MONITORING

The core objective of business activity monitoring (BAM) can be better explained by alluding at one of the many interesting characters of a popular American TV series. The character’s name was Corporal Walter ‘Radar’ O’Reilly. This fictional character, in his early twenties, displayed a unique trait. He had some extrasensory perceptions and could appear by his commander’s side even before he was summoned. This trait of his earned him the nickname ‘Radar’. Radar could anticipate events viz., getting to hear the wails of the wounded patients in an approaching helicopter before anyone else could, predicting his commander’s next orders by just overhearing his phone conversation and thus was in command and ahead of all situations.
In today’s enterprise, it is getting increasingly important to take informed decisions in a timely manner by assimilating information present in various silo data sources. Such decisions have a huge impact on business parameters like revenue, profitability, customer satisfaction and agility. Enterprise IT systems like Customer Relationship Management (CRM), Enterprise Resource Planning (ERP), Business Process Management (BPM), Order Management Systems (OMS), etc., have brought in considerable efficiencies in their own right to the business. However, more often than not, the core processes within the business spans multiple systems and is seldom localized to one.

Let your imagination run a little wild and try to think how an enterprise could change if it had its own ‘Radar’ O’Reilly? Someone or something that can deduce next steps, predict impact of events, put two and two together from different systems and spot/plug any hole in the business process before the damage is done. This could bring about tremendous agility, resilience and efficiency in business processes.

A layer that can monitor business processes in the above stated manner should be able to understand and perform real time monitoring of vital signs in the context of a business process. Wherever possible this monitoring should be proactive. It is not just failures that have to be monitored. Any deviation from the normal trend based on historic data has to be flagged and alerted to the right stakeholders with minimal time lag. Ad hoc reports and dashboards should be available for the decision making community within the business. That is when BAM becomes the ‘Radar’ of one’s business. The benefits of such a layer are manifold and the following illustrative business scenario depicts some of them. Consider an e-commerce scenario with the core business process of fulfillment of orders placed online. The customer places orders on the company’s website and is intimated of a delivery date. In an ideal scenario where everything goes as planned, the goods ordered by the customer are delivered on the date promised.

Now consider this variation—due to an unforeseen increase in the number of orders placed online, the logistics of the delivery systems viz., trucks, delivery boys, etc., are operating at full capacity. The activity monitoring layer could potentially correlate the high volumes being handled by the system to a potential delay in delivery times. This can trigger an alert or a communication to the customers informing them about the delay before it actually happens.

Consider a more interesting scenario of inventory management for the e-commerce site. Let us assume that there is a forecast for thunderstorms for the next two weeks in some of the areas where the monitoring layer can send an alert to the inventory management group to stock up on rainy weather essentials.
like umbrellas and raincoats. This could put the business in a better position to meet the unforeseen increased demand.

Such a system or Radar O’Reilly can open up a myriad of possibilities when it comes to business processes.

TECHNIQUES AVAILABLE TODAY
Though BAM is a relatively new term, there are some techniques that have been around for a while. The front-runners amongst these are IT system monitors, Business Intelligence (BI), Reporting and Analytics, and Business Process Monitoring (BPM). Each of these has its own pros and cons when it comes to BAM. Let us take a look at these three techniques in a little more detail:

**IT System Monitors:** Many businesses have implemented very effective IT systems monitoring measures in an effort to monitor failures and at times success events, in various applications in the enterprise. The objective has been to alert support services in a timely manner so that the service level agreements and availability levels of the application are met. This definitely helps in reacting and resolving any error conditions at the application level. However, this technique has quite a few shortcomings when it comes to monitoring activities at a business process level. This technique is more reactive than proactive as it monitors applications, logs, network, server hardware in isolation and not the business processes on the whole. It also monitors failures and malfunctions only, while in reality a business activity has to be monitored from both - a success and failure standpoint in order to provide meaningful activity metrics. It does not have any knowledge of KPIs set for various business processes that are executed within the application and hence is not able to detect degradation of any of KPIs.

The scope of alerts is limited to the application and does not correlate to failures in other applications participating in the same process. Business processes are executed across applications and lack of this correlation fails to provide meaningful interpretations of events. It also does not detect variations in the business process even when the application is functioning normally.

In spite of all the shortcomings, system monitoring applications have been, at times, retrofitted by organizations to provide a semblance of BAM. There have been conscious efforts as part of application design to log success events as well, in addition to the traditional error logs. Listeners poll the success logs and correlate different events logged in various applications using a unique correlation id for each business process transaction. However, this approach has a serious effect on application performance when it has to log informational messages for success.

**BAM works on proactive mode and re-aligns IT system monitors that work on reactive mode and repair strategy**
events and have a real time polling mechanism as well.

**Business Intelligence (BI):** BI has been prevalent for quite some time now and combined with extensive reporting and analytical capabilities continues to be the backbone of the decision making process of organizations. The BI process involves processing gigabytes of historical data records stored in huge data marts at predefined frequencies using ETL tools and loading it into data stores that are eventually reported on. To a large extent, BI does enable businesses to make informed decisions. However, it has some limitations when it comes to BAM:

- BI and data warehousing are essentially batch processes and are not real time. Real time and proactive changes/decisions cannot be easily made using BI.

- BI reports and dashboards are pre-configured. Changes to or creation of new reports have a high cycle time introducing a lag in decision making.

- BI is more of an afterthought than real time monitoring. Alerts cannot be generated even if there is a failure. Traditional system monitors have to be leveraged for alerts.

- Trending and statistical analysis is performed manually. Historical trends are not fed back into the monitoring framework in order to flag events that are deviating from the usual trend.

**Business Process Management (BPM):** Business process management endeavors to manage, model and automate business processes in the enterprise. One of the key tenets of using a BPM system within an enterprise is to externalize all business processes that are embedded deep in applications into a central location and orchestrate the flow of the process. BPM does achieve quite a lot from that perspective in terms of improved process agility and centralized governance of critical processes. However, having a BPM infrastructure also falls short of the needs of monitoring a business activity. The following are a few shortcomings of BPM as a BAM solution:

- BPM only has the knowledge of the business process; it does not have any correlation to other external factors viz., application events, infrastructure, historical data, statistical analysis, etc.

- BPM does not have monitoring built in. Hence, alerts based on process success/failures cannot be generated. Moreover, the success/failure cannot be compared against a trend to make intelligent reports that will help make the right changes or decisions to activities.

Table 1 contains the summary of the pros and cons of the various approaches defined in the section above. It also provides a star rating for each of these approaches’ alignment with BAM.

**BAM SOLUTION SCENARIOS**

A typical business process spans across a few large systems that are in turn made up of other subsystems and components. As a business entity, for instance — an order for a broadband connection, flows from one system to another, it undergoes some level of transformation as it gets processed. Figure 1 outlines the flow of a business entity through the business process.
As can be inferred from the Figure 1, after the customer places her order for a new broadband connection online, it flows through a number of different systems before it is fulfilled. Basic steps that must be executed to complete the order are:

- The order must be validated online for availability and access in the geographical area
- A broadband router or a modem must be shipped from the warehouse to the customer’s address

The problem with this set up is that each of the participating systems is independent of each other. They have their own proprietary alerting and reporting mechanism. This usually leads to a scenario where the customer first finds a problem with the system in the form of - “I haven’t received my broadband router yet” to “I was supposed to get a discount with my phone and broadband combo,” before the service providers do.

A BAM solution can be employed in order to turn the tables around by:

- The customer’s phone line and broadband connection must be linked to the same account for billing
- The CRM data should be set at the call center to assist her through any query

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<table>
<thead>
<tr>
<th>IT Systems Monitor</th>
<th>BI</th>
<th>BPM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pros</strong></td>
<td><strong>Cons</strong></td>
<td><strong>Pros</strong></td>
</tr>
<tr>
<td>* Monitors failure and success events</td>
<td>* Reactive than Proactive</td>
<td>* KPI Aware</td>
</tr>
<tr>
<td>* SLA and Availability Focused</td>
<td>* Diluted sense of business process</td>
<td>* Slice and Dice Functionalities</td>
</tr>
<tr>
<td>* Failure focused</td>
<td>* Supports Trend analysis</td>
<td>* Reactive than Proactive</td>
</tr>
<tr>
<td>* KPI unaware</td>
<td>* Lacks correlation across applications</td>
<td>* No feedback to operational systems for trend based monitoring</td>
</tr>
<tr>
<td>* Cannot process variations in business process</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Pros and Cons of available Business Process Monitoring Techniques
Source: Infosys Research

Figure 1: Sample Business Process
Source: Infosys Research
Tracking the collected data against defined measures

Raising alarms for applications and people alike when things do not add up.

Figure 2 depicts the current deployment at an enterprise that uses Business Process Management (BPM) but not BAM.

This enterprise can be extended to incorporate BAM solution as depicted in Figure 3.

In this scenario, the BAM adapter is integrated with the BPM engine that in turn is integrated with all the business process systems [Fig. 3]. The BAM adapter tracks the business entity through the business process and keeps comparing it against the benchmarked or defined values. For instance, using the example outlined above, let us say that for efficient delivery, the order should not sit with the inventory system for more than eight hours. The BAM adapter will track every order that goes into the inventory management system and if it does not receive a status change within eight hours, it can send an email or an SMS alert to the associated system owner. If an application programming interface (API) hook is available to the inventory management system, then it can also fire an alert for that specific order. In case the order’s status is not updated within 24 hours, it can send an email communication to the customer with updated delivery date.

Besides the obvious advantage of introducing agility and resilience in the business process, BAM can also help in cutting down
the call volumes received by the call center by proactively informing the customer about the change in their order status.

Businesses that do not use BPM functionality and instead rely on a middleware to orchestrate the business process can incorporate the BAM functionality into the existing ones using an enterprise service bus (ESB) and a logging framework [Fig. 4].

In this case, the applications that cater to the part of the business process will need to use a BAM logging framework for updating the status of the business entity through its lifecycle. Multiple instances of these logging frameworks can be deployed throughout the enterprise and all of them can forward the logging calls to the BAM engine through the use of an ESB or an asynchronous messaging service.

The BAM engine can resurrect the lifecycle trail of the business entity from these logged messages, track its progress and raise alarms, alerts and communications as appropriate.

THE BAM PROCESS MATRIX

The key input to the BAM engine can be collected in the form of a BAM process matrix that interlinks different systems from the business process standpoint and also outlines the vital signs to monitor along with the corrective and proactive actions to take in case of a contingency. A reference BAM process matrix is depicted in Table 2 overleaf.

As depicted in the third row of the of Table 2, if the estimated delivery date is not generated by the inventory system within three hours of receiving the order, the BAM engine will first fire an API call to check if any detailed status message can be obtained. This will be followed up by sending an email alert to its system owner along with the order and status details. Proactively, the BAM engine can also update the billing engine to delay the billing start date of this order.
INTEGRATING INTELLIGENCE

A typical business process is influenced by both internal and external sources of information. The BAM model described so far only takes the internal sources of influence into account. The same model can be extended to include external sources of information like weather forecasts, selective news feeds and customized dashboard for manually feeding in intelligence information collected offline. Figure 5 depicts the manner in which this system can be extended.

For instance, when the model depicted above receives some critical weather information about an incoming hurricane, it can update the inventory system to stock appropriate items in the store. Considering another instance, the administrator can pull up the list of best selling items during the Christmas season from the BI system and manually feed it in using the Admin dashboard. Sometimes a few critical news items can also influence the business process. For example, if a popular news source publishes the reviews of a music album, rating it with 5 stars, the system can send out an alert to increase its inventory. Alternatively, if a stocked music album has got really bad review, then the pipeline orders for restocking it can be put on hold without any manual intervention. This can offer major advantage to the retail businesses.

IMPLEMENTATION CONSIDERATIONS

Although the previous sections highlighted some of the key advantages of rolling out BAM in an enterprise, it should also be pointed out that rolling out a truly effective BAM process takes a good amount of effort and commitment from the business side. Here are a few things that the key stakeholders should be aware of before they decide to go ahead with BAM:

BAM is a Business Solution, Not a Technology One: The first step in executing the BAM rollout
is a systematic study of the business process in context. After the process has been studied, a BAM matrix (Table 2) needs to be created which will outline the key stages in the lifecycle of a business entity as it goes through the business process. Once defined, this matrix will be used to configure one’s BAM solution to monitor the right vital signs and take the right corrective action. This is purely a business activity and does not involve much of technology dependency. To make this activity successful, one needs to ensure that one can commit the needed time and effort from business folks.

**Be Prepared To Embrace and Sell the Idea of This Change:** For BAM roll out to be effective, a lot of existing key business applications will need to change. This is important to get the right data out of the applications and make sense of it before it can be acted upon. The good news is that most applications that have been architected for extensibility or are SOA based will not have many issues in incorporating this change. For the others, willingness and preparedness to accommodate this change has to be understood. Most of the time this would involve selling idea to all the parties involved and showing them how this investment is needed for the greater benefit of the business. It would make sense to factor this activity as a part of BAM rollout plan.

**Addressing the Compatibility Aspects:** While the BAM solution sounds very attractive, there is a last leg problem that one should be aware of. Since BAM works in the capacity of information aggregator, it needs to interface with a lot of applications based on diverse platforms and technologies. In order to avoid platform and technology specific support framework for this integration, it is important to stick to the SOA principles and use web services wherever possible. Web services can be easily integrated with heterogeneous platforms and technologies and can solve the compatibility needs.

<table>
<thead>
<tr>
<th>Life cycle Stage</th>
<th>In System</th>
<th>Vital Sign</th>
<th>ETA</th>
<th>Corrective Action</th>
<th>Proactive Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiated</td>
<td>Online</td>
<td>Order Number Generation</td>
<td>15 Mins</td>
<td>N/A</td>
<td>Heads up to Inventory</td>
</tr>
<tr>
<td>Accepted</td>
<td>Order Management System</td>
<td>Shipping Record</td>
<td>24 Hours</td>
<td>Email Alert to system owner</td>
<td>N/A</td>
</tr>
<tr>
<td>Processed</td>
<td>Inventory</td>
<td>Estimated Delivery Date</td>
<td>3 Hours</td>
<td>1. Status Change API 2. Email Alert</td>
<td>Update to Billing (Account creation)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tracking Number Generation</td>
<td>5 Hours</td>
<td>1. Email Alert to system owner</td>
<td>Update to Shipping System Email to customer</td>
</tr>
<tr>
<td>Shipped</td>
<td>Shipping</td>
<td>Tracking Number Status Change</td>
<td>Published lead time</td>
<td>1. Email to Customer 2. Email Alert to System owner 3. API Call to Warehouse System</td>
<td>Update to Billing &amp; CRM Systems</td>
</tr>
<tr>
<td>Active</td>
<td>Billing</td>
<td>Account Number Activation</td>
<td>2 Days</td>
<td>1. Email alert to system owner</td>
<td>Update to CRM</td>
</tr>
<tr>
<td>Active</td>
<td>CRM</td>
<td>Customer Record Generation</td>
<td>2 Days</td>
<td>1. Email alert to system owner</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*Table 2: Reference BAM Process Matrix*  
*Source: Infosys Research*
So, if a plan to roll out a custom built BAM solution should factor in compatibility with existing needs and the time it can take to integrate it with other applications. If not addressed properly and in the early stages, this constraint can single handedly ruin BAM experience.

**To Start on a Large Scale or Not:** For BAM to deliver all the promises that it makes, it is very important that it is rolled out in all the applications that participate in the business process. Depending on the size and complexity of the business this can be a good or a bad thing. For small business processes, it should not be much of a hassle, but for large scale business processes, it may need significant effort and time to roll out BAM across the whole process. The disadvantage with this approach is that it can take too long for the implementation to complete across all the required applications, thus increasing the anxiety for the final outcome and consequently killing the excitement that it can bring about.

Before one starts implementing BAM in an enterprise, one needs to understand the complexity of the business process and deduce if it makes any sense to deploy BAM in parts. For instance, if one finds that the shipping and CRM systems are the most active of the six systems that participate in one’s business process, then one can have BAM integration done with these systems first. After one starts seeing the results from BAM for these two systems, it can be rolled out across the remaining four systems in the business process. Alternatively, if one is skeptical about the benefits that come out of BAM, risks can be cut by rolling it out in smaller increments.

**IMPROVE ENTERPRISE AGILITY THROUGH BAM**

In many respects, BAM is a key enabler for achieving agility in the business processes across the enterprise. Agility is all about change, about how fast a business can react and respond to change or how fast a business can take pre-emptive measures to respond to change.

With BAM, one can address the following key pre-requisites for achieving agility in the enterprise:

- Visibility into day-to-day Operations – Faster response to deviations from the trend
- Awareness of Change – Both from external and internal sources
- End-to-end View of Processes – With vital signs, corrective and proactive measures to be taken by stakeholders.

Figure 6 depicts how the BAM solution proposed till now in this paper maps to the above stated pre-requisites.

It is important to identify the key factors that can increase the agility of the business. For instance, the business should focus on external sources that are applicable to the domain, should identify key stakeholders who have to be communicated the change and also identify people who can act effectively. The more quickly one reaches the respond stage, the more agile one’s business will be.

**BUSINESS PROCESS PERFORMANCE AND BAM**

In the conventional sense, BAM does not have much to do with performance of an application. It does not involve performance modeling, application tuning or any other activity that is usually associated with the performance engineering domain. But if looked at from a business process perspective, it does provide an
approach on how to monitor, tune and evolve it for performance.

Businesses which adapt this approach will reap the benefit by having agile, responsive and resilient business processes. This in turn will lead to lower operational costs and increased customer satisfaction. In other words, this approach will increase performance of a business process and this very essence ties it to the world of performance engineering.

CONCLUSION
BAM is in its infancy as we write this paper but the promises that it brings along are quite exciting. If rolled out in the intended manner, it can go a long way towards bridging the technology-business divide. The enterprises that roll this out first will have clear advantage over the competition in containing costs and focusing on what matters. Once BAM becomes an industry standard, it can evolve to automatically rope in customer feedbacks and perhaps add some community features that enable customer to influence what is monitored and how.

Agility is the buzzword these days and enterprises are moving to SOA to enable the business to be agile to the changes in the market place. In our opinion, a well architected BPM solution complemented by a BAM engine can provide businesses with a great amount of agility in their day to day business. BPM will provide the end-to-end process view with flexibility for change and BAM will complement it as the change monitoring and messaging infrastructure.

Although the change could be anything that happens in the marketplace that can be monitored, for us, the real excitement lies in mining news for changes that can alter the business landscape. It will be truly exciting if a BAM engine can mine different news feeds, sort out the information that is relevant to the business and automatically influence the systems. That is
when the real intelligence will be able to kick in and technology will not only help businesses to thrive but also evolve to a whole new level. That will perhaps be the time when every business gets to match up to the famous Toyota model for efficiency, the Wal-Mart model of operational costs and the UPS model for adaptability.

REFERENCES
2. The CEO’s Tech Toolbox, Business Week, 2005. Available at http://www.businessweek.com/technology/content/jul2005/tc20050726_8027.htm
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