BPM and Workflow Handbook 2010

Spotlight on Business Intelligence

EDITED BY LAYNA FISCHER

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Foreword

It is my pleasure to introduce to you WfMC's tenth annual BPM and Workflow Handbook, rounding out a complete decade of this important reference work. Throughout the decade, led by Layna Fischer, the Handbooks have consistently focused on the leading trends and advancements in the process technology marketplace.

Year 2009 was a real turning point in the process technology space. It was a year where a number of key pure-play business process management suite (BPMS) vendors were acquired, and are now incorporated into the stacks of large technology vendors. Many analysts responded asking the question whether we were seeing the end of BPM, but such a shopping spree should be viewed instead of the ultimate complete legitimization of BPM. The consolidation of the industry indicates that it has become mainstream. A budget item for BPM technology is no longer exotic and hard to justify, but instead a normal and frequently required part of IT spending. It seems that BPM has come of age.

Looking over the decade, we have seen both the introduction and the maturation of an area of technology known as business process management (BPM). Back at the time of the first Handbook, in 2001, the acronym BPM would have been unfamiliar to all but a few people. This handbook in 2001 was called simply the "Workflow Handbook." It is interesting to see the introduction of the term *BPM* at about that time, later to rise and completely eclipse the use of the term *workflow*. BPM promised many different things to different people: in fact even today, there are two different personalities of BPM. BPM means two distinct things to two different sets of people.

To some in the information technology sector, BPM means essentially a way to develop solutions that integrate information from many separate applications across the enterprise. This kind of BPM is an extension of the Enterprise Application Integration (EAI) field. As applications gain the ability to deliver raw information to remote requesters, they have become services which play a part in a Service Oriented Architecture (SOA). To these people BPM has represented the ability to orchestrate web services (using BPEL), and to make composite applications by integrating the results from many separate application.

To others, BPM represented the idea that management would represent the work of the organization as business processes, and they then manage these processes over the long term. This approach is completely separate from the technology (we are talking about processes, which, in many cases involve humans) but still technology was developed to help in the describing of processes, and the facilitation of the work to manage and maintain the processes. The end goal is the same; better support for the business. Proponents in this group will sometimes vigorously protest that BPEL and the integration technology are not central to the management aspect of BPM.

This bifurcation into two personalities of BPM still exists. What is interesting about the consolidation of 2009 was that companies in the integration space were acquiring companies in the management space. This allows the key vendors to offer the entire range from low level IT integration to higher level organizational management of processes.

While BPM crosses the gap into the mainstream, those who chase the cutting edge are asking "what is next?" The first half of 2010 was filled with soul search-

ing for a "new definition" of BPM. Is it going to be Social BPM? Dynamic BPM? Consider that BPM is built on the concepts of Scientific Management, and idea that perfecting a process to be repeatable and efficient is the best way to get work done. The main push behind BPM in recent years has been toward making more and more elaborate process definitions with increasing capabilities for handling information flow. Notation, such as BPMN, has been elaborated toward the precise definition of information flow, and it is now seen as primarily a programming tool for process specialists. The idea of mass production of processes, done thousands of times in exactly the same way, achieving the benefits of scalability, has clearly been shown not only possible, but readily available. What is next?

Many analysts noted the rising importance of "Case Management" in the latter half of 2009 and early 2010. Case Management represents the antithesis of scientific management. Case Management is founded on the idea that getting the work done is more important than perfecting the process. It goes further than this, in saying that the details of the case are so overwhelmingly responsible for the plan of attack, that it is not useful to isolate the plan from the case itself. A large investment in creating a plan is not justified when the plan is used only once. Each case must be handled by an intelligent human being who can take in the situation, bring to bear experience and knowledge gained from earlier cases, and synthesize for this particular case the process necessary. It is the opposite of BPM because instead of trying to find one single "best" process, Case Management is oriented toward finding a different and unique process for every different situation, and tools that support custom on-the-fly elaboration of processes.

The process community is having a hard time understanding the difference that case management brings, because after a decade of struggle to get people to view all work as a process, it is hard then to see another view. Because the case manager is not a programmer, it can't be exclusively a paradigm around programming the integration. Forrester has talked about Dynamic Case Management, IBM announces Advanced Case Management, and the WfMC has been active in trying to refine the concepts under the term Adaptive Case Management (ACM). It seems that while BPM is an approach that works well for predictable processes, Case Management is a separate approach that works for unpredictable, emergent processes. Interestingly, some of the same technology underlies both of these approaches.

The Workflow Management Coalition continues to push forward on standards to enable process model interchange, working directly with the BPMN finalization task force, as well as with other efforts to define conformance classes to allow for distinct levels of interoperability. WfMC remains the only standards organization focused exclusively on process technology.

Which brings us to the reason to focus this volume on Business Process Intelligence. Regardless of whether you design a fixed definition in advance for a predictable process, or whether a case manager extends the plan for an unpredictable process while working, the results can be analyzed with process intelligence technology. Retrospective analysis can tell us if the processes are going according to plan, and can tell us if the plan itself is a good idea. In cases where work was performed without the guidance of a process, process mining, also known as automatic process discovery, can tell us what the process has actually been without having to involve people in lengthy, and error prone, interviews. Process mining can tell us what is efficient and inefficient about an existing work pattern, and it can give us a jump-start on new BPM implementation efforts when no previous process definition exists. Business (Process) Intelligence is a field that is just be-

ginning to show very promising results. Eleven independent chapters bring us views of this topic. After all, in the end, it is process analytics that keeps us all honest. Because it can measure performance, Business Process Intelligence is a critical part of delivering on the promise of improving performance of the business.

While the next decade remains unpredictable, it is only through the careful consideration of current trends, and maintaining an ability to respond with agility, that one can hope to navigate successfully. Representing the membership of the Workflow Management Coalition, I hope you find these articles helpful in your efforts to keep up to date on the current trends in the process technology community.

Keith D. Swenson, Fujitsu America, USA and
Chair WfMC Technical Committee

Introduction

Layna Fischer, Future Strategies Inc. USA

Welcome to the *2010 BPM and Workflow Handbook*. This edition marks the 10th year of publication and each year, in collaboration with the WfMC, we have produced a valuable handbook capturing state-of-the-art in workflow practices and for the past few years we expanded our focus to include articles on BPM along with spotlights on industry niches such as Healthcare, Human Workflow and Government.

This year we focus on *Business Intelligence* to illustrate how Business Process Management and Business Intelligence are increasingly intertwined. Linking business intelligence and business process management creates stronger operational business intelligence. Users seek more intelligent business process capabilities in order to remain competitive within their fields and industries. BPM vendors realize they need to improve their business processes, rules and event management offerings with greater intelligence or analytics capabilities.

This is a book for business people who just want to understand the how and why of process automation and integration in simple non-jargon terms. It is also for the technical practitioner looking for the latest insights into where BPM standards are heading, how others are managing implementations and more.

Throughout the book international industry experts and thought leaders present significant new ideas and concepts to help you plan a successful future for your organization.

- SECTION 1: SPOTLIGHT ON BUSINESS INTELLIGENCE covers a wide spectrum of viewpoints and discussions by experts in their respective fields. Papers range from an examination of the *Knowledge Work and Unpredictable Processes* through to Using *BPM to Drive Clinical Intelligence* and *Predictive BPM.*
- SECTION 2—THE BUSINESS VALUE OF BPM AND WORKFLOW introduces new key concepts and sets out the business case for workflow technology and BPM. This perspective is covered by papers that provide practical information on BPM (including case studies) designed for an audience of business users.
- SECTION 3—STANDARDS AND TECHNOLOGY. BPM standards have evolved from technical nuance to a business imperative. This perspective is covered by papers on system structure and values, operation and scalability issues, written for an audience of Information Technology (IT) professionals.
- SECTION 4—DIRECTORY AND APPENDICES offers an explanation of the structure of the Workflow Management Coalition and references comprise the last section including a membership directory.

SECTION 1—SPOTLIGHT ON BUSINESS INTELLIGENCE

The use of BPM and BI together is not a new concept. Business Process Intelligence (BPI) takes on new meaning and importance as organizations become process-centric and standards and technologies mature and converge. This chapter brings discusses key trends of where organizations moving toward bringing together products and methodology to improve business performance beyond BPM and BI: Combining the 4 Bs: Business Design + Business Process + Business Intelligence + Business Rules, Event Driven Process Intelligence, and BPI as a Cloud or Appliance.

the state of the art. Subsequently, a team of several researchers developed the solution for the problem. This work has had several validation and verification stages to prove its feasibility and effectiveness, including a prototype developed using a world-class open source BPM tool, and standard programming languages.

er experience and how to transform customer experience to achieve measurable business goals. Business Process Management and the convergence of technologies *(such as Portals, web 2.0, BI, Content Management)* are two key elements of this transformation and hence we will focus on how the convergence of various technologies led by BPM will help achieve the business goals around Customer Experience Transformation (CET).

SECTION 3—STANDARDS AND TECHNOLOGY 189

HOW TO OPTIMIZE CAPABILITY: CENTERED ENTERPRISE INTEGRATION 191

Nathaniel Palmer and Jason Adolf, SRA International, Inc., VA, USA

Increasingly, COTS BPM and SOA platforms are leveraged as the bones of architecture and approach, allowing for the maximum amount of flexibility while reducing the need for tenuous custom coding. Yet the 'Integration-centric' approach most commonly followed obviates the inherent benefits offered by BPM, notably the ability to deliver business capabilities, rather application functionality.

Taking a capability-centered approach to extracting and exposing existing application functionality, while mapping these to new processes and interaction models, allows organizations to realize optimal value from current generation COTS BPM and SOA platforms. This approach begins with modeling business concepts as addressable capabilities, and then extending these into specific deployment models which leverage BPM and SOA for capability-centered business integration. This chapter gives step-by-step instructions on optimizing this capability.

XPDL 2.2: INCORPORATING BPMN 2.0 PROCESS MODELING EXTENSIONS 203

Robert M. Shapiro, Global 360, USA

In June 2009 the OMG voted to adopt the BPMN 2.0 specification which then entered the Finalization Task Force (FTF) phase. At that time the WfMC initiated work revising XPDL2.1. The new version, XPDL2.2, is described in this paper.

XPDL2.2 is intended as a preliminary release which supports the graphical extensions to process modeling contained in BPMN2.0. In fact, the BPMN specification addresses four different areas of modeling, referred to as:

- Process Modeling
- Process Execution
- BPEL Process Execution
- Choreography Modeling

We focus only on Process Modeling. Within that we define several sub-classes to support process interchange between tools. This is discussed in a later section of this paper.

WORKFLOW CONTROL-PATH INTELLIGENCE AND ITS IMPLICATIONS 217

Haksung Kim, Dongnam Health University and Kwanghoon Kim, Kyonggi Univ., Rep. of Korea

In this paper, we describe the basic concept of workflow control-path intelligence and its implications on the arena of business process analysis, prediction and optimization. That is, we introduce a series of models, algorithms and frameworks for analyzing, predicting, optimizing and rediscovering the control-path intelligence from a workflow model. Conclusively, we strongly believe that the workflow control-path intelligence must be an essential factor for improving the quality of workflow model itself as well as a pioneering research issue in extracting other workflow-related knowledge and intelligence to rapidly and reliably deliver agile services to businesses and IT customers.

WORKFLOW DESIGN PATTERNS FOR DEVELOPING AND MAINTAINING E-BUSINESS WORKFLOW SYSTEMS

Farhi Marir and John Ndeta, Knowledge Management Research Centre, Faculty of Computing, London Metropolitan University, UK

ABSTRACT

Designing an e-business workflow system for your organisation using a traditional framework is not appropriate as it ignores the human dimension of organisational knowledge creation and the dynamic situations encountered in organisations collaborative work

processes in the new e-business environment. As a result e-business workflows systems developed using this framework are less capable in dealing with the new e-business era which is characterised by an increasing pace of radical, discontinuous and unforeseen change in e-business processes.
This paper highlights the limitation of this traditional framework and presents an alternative framework for designing flexible and dynamic e-business workflow management systems that respond to the continual changes of e-business processes.

Designing an e-business workflow system for your organisation using a traditional framework is not appropriate as it ignores the human dimension of organisational knowledge creation and the dynamic situations encountered in organisations collaborative work processes in the new e-business environment. As a result e-business workflows systems developed using this framework are less capable in dealing with the new e-business era which is characterised by an increasing pace of radical, discontinuous and unforeseen change in e-business processes.
This paper highlights the limitation of this traditional framework and presents an alternative framework for designing flexible and dynamic e-business workflow management systems that respond to the continual changes of e-business processes.

Process modeling offers a very effective means for understanding and analyzing what needs to be improved. Process models are also used for many other purposes such as process automation, which increases the effectiveness of process improvement especially when organizations need to react quickly. Although there are numerous studies on various approaches to be separately applied to process modeling and process automation, the relationship and dynamics between the two still remains undiscovered. This paper presents the results of an exploratory study on the usability of process models developed for process improvement to be applied to the automation of processes with selected Business Process Management (BPM) tools.
The case study covers two processes in a software development unit of a large organization. The extended Event Driven Process Chain (eEPC) notation was utilized for process modeling and BizAgi, WebMethods and Intalio BPM suites for automation. A comparison was made concerning time spent to carry out the modeling and automation and the effectiveness of the BPM tools was analyzed.

Intelligent, Automated Processes: Embedding Analytics in Decisions

James Taylor, Decision Management Solutions, USA

The challenge of putting BI to work in business processes is that reports and dashboards only work in manual processes. If the process is automated, if straight through processing is called for, then the analytics required are different. Embedding these analytics in rules-based decisions is the ideal way to analytically enhance these processes and build intelligent, automated processes.

BUSINESS INTELLIGENCE AND BUSINESS PROCESS

There is a clear and obvious synergy between Business Intelligence (BI) and Business Process Management (BPM).

BI can use BPM

BI helps us understand what is happening in our business, what our results are, how well we are doing. If we are using BPM to define and manage our business processes then clearly information about our processes should be included in this analysis. We can consider the number of times a process executes, which steps are involved in each execution and how long things take—all of these are data about how our business is operating.

BPM can use BI

BPM helps us structure and manage the work that must be performed in our business. Often the tasks we need to perform, or how those tasks are carried out, are dependent on the current state of the business. The analysis of the state of our business using BI can and should be an input to these tasks. For instance, information about past customer orders or the frequency with which a particular supplier misses deadlines drives behavior in specific tasks.

BI is particularly helpful for Decisions

BI is particularly helpful to a certain subset of the tasks within our business processes-decisions. When we must decide how to treat a customer, what the risk of a particular supplier being late or how likely a particular approach is to work for a particular transaction, BI provides insight and information to help us do that.

BI and BPM can and do complement each other and organizations that adopt both approaches and technologies and use them together can gain significantly from the synergies inherent in these two closely related areas.

THE CHALLENGES OF AUTOMATED PROCESSES

When it comes to automated processes, however, there are challenges in combining BI and BPM. In an automated process, where the objective is straight through processing, the tasks or activities in our process are handled by computers, by systems, not by people. Herein lies the challenge as BI products and approaches focus on the presentation of information to people so they can use that information effectively. A dashboard, for instance, that allows a manager to see the status of their department or a report detailing last month's sales for a sales manager. With no people involved, automated processes have no obvious home for BI. There is no-one to watch the dashboard, no-one to read the report.

Automated processes need insight too

Yet the need for applying insight about our business is real and compelling. Just as people add intelligence to a manual process by using information to make better, more intelligent, decisions so an automated process must be informed by what we know. We need to take what we know about how our business operates, by what has worked or not worked in the past and the current state of the business and apply this business insight in the context of our automated processes.

To do this we must address three critical issues:

1. We must understand exactly what decisions are being made in our process.
   Computers are much more literal than people so much greater precision in definition is essential
2. We must be able to turn our data into insight that can be consumed by a computer.
   Traditional BI representations are aimed at people so something different is required.
3. We must be able to define the actions to be taken, and the constraints on those actions, so that the computer can act not just "understand." We need the process to keep moving, it cannot wait for a person to take action, so the computer must be able to act on its own.

DECISIONS AND PROCESSES

Building intelligent, automated processes requires that we understand the decisions in our processes. These decisions give us the points of control that we need and the places where insight might make a difference.

What is a decision?

Whether made by a person or a computer, a decision is a selection, a choice, made from a range of possible options. It might be a selection from Yes/No, from a list of products or even from a numeric range. A decision also involves taking action not just adding to what is known. It is not enough to find out something new or to create new knowledge; we must act on it if what we are doing is to be considered a decision. Decisions are also typically made after some consideration, after some analysis. Making a decision is a task, an activity within our process not just a branch or gateway within it.

Different types of decisions

Decisions are embedded in every kind of process and can be strategic, tactical or operational. Strategic decisions are the responsibility of the executive suite and are typically one-off decisions that make a significant difference to the overall direction of the organization. Tactical decisions are about managerial control, setting short term and local policies within a strategic framework. It is the last group —operational decisions—that is critical when it comes to automated processes.

- ✓ *Understand the decisions that matter to your business. Consider a decision audit to see what strategic, tactical and operational decisions you have that make a difference to your business processes. A broad but shallow understanding of your decisions will help you focus your effort.*

Automated processes are operational

Automated processes are high volume, high throughput processes or those requiring very fast turnaround times. Most organizations do not automate processes otherwise. While high performance, high volume processes may be

constrained by tactical decisions or re-designed due to strategic ones, it is *operational* decisions that are embedded in them.

Little decisions add up

Operational decisions are low value, high volume decisions each of which impacts a single customer, a single transaction, a single instance of the process of which they are part. Just as an operational process can be automated by defining a standard way to execute the process and then doing so repeatedly, so can an operational decision be defined in a standard way and executed repeatedly in the context of such a process. While these decisions are individually low value, their cumulative value can be significant. For instance the individual decision about how to price a particular insurance policy might have a modest value but even a small insurance company makes many such decisions, ensuring that the overall value of the way we make the underwriting decision is significant.

Insight-driven operational decisions

Not every operational decision requires insight to make correctly or effectively. Deciding if a customer is eligible for a product, for instance, or deciding what the right discount is for a particular customer are operational decisions but they may be driven by a fixed set of business rules (of which more later). Two main categories of operational decisions do, however, require insight and these can be described as risk-based and opportunity-based operational decisions.

Risk-based operational decisions

In risk-based operational decisions, insight is required as to the risk of this particular transaction, this particular customer. For instance, an assessment of how likely this transaction is to be fraudulent given the history of other fraudulent transactions. This kind of decision includes decisions about fraud, about credit or perhaps about deliveries or suppliers where there is a risk of a negative outcome. Without insight, information, as to the likelihood of that negative outcome it is hard to make a good decision.

Opportunity-based operational decisions

Opportunity based decisions do not have a bad outcome but require that a choice is made between different degrees of opportunity. For instance, in marketing decisions, the wrong offer represents a lesser opportunity than the right offer. Insight into which choice will offer the greatest opportunity is not critical but will maximize the value of the decision being made.

- ✓ *Understand the link to performance management and metrics/KPIs*
  One of the critical success factors for effective management of decisions, and effective use of analytic insight in decision making, is the linkage of decisions to the metrics and KPIs they impact. Without this understanding it is hard to tell a good decision from a bad one and hard therefore to determine what insight will help you make a good decision.

Decision Services

To embed decisions in business processes we must develop decision services. A decision service is a service that answers business questions for other services, a service that makes decisions. Such a service should generally be stateless and have no side-effects (such as emails sent or databases being updated) so that any process that relies on the decision can use the decision service without fear of unintended consequences. Decision services have simple interfaces, allowing data to be passed in and returning simple information about the decision made and perhaps the way in which the decision was made.

EMBEDDING ANALYTICS IN DECISIONS

Once we have identified a risk-based or opportunity-based operational decision that we plan to implement as a decision service, we must determine how analytic insight can help us and what kind of analytic insight we need. Clearly visualizations, reports and dashboards are not going to be helpful to delivering insights to a decision service in an automated process. There are, after all, no eyes to look at these things. Instead we must develop the insight we need as something executable, something our automated process can use.

Different kinds of analytic insight

Analytics, analytic insight, covers a wide range of possible meanings. One of the simplest definitions of analytics is:

> Analytics simplify data to amplify its meaning.

This clearly states the purpose of analytics—to make it easier to get value, meaning, from data—but also covers a wide range of techniques and technologies. In particular it includes a range of analytics from business intelligence to descriptive analytics, predictive analytics and even optimization. It can be helpful to consider these different techniques as points on a spectrum, as shown in Figure 1 below.

As we move from left to right—from business intelligence to optimization—we increase the sophistication of the analytics involved. Descriptive analytic techniques or data mining creates segmentation, clustering, rules based on what happened or what worked (and did not work) in the past. Predictive analytic techniques turn uncertainty about the future into usable probabilities, giving us propensities or likelihoods for future behavior on the part of customers, parts, suppliers etc. Optimization and simulation help us manage the complex tradeoffs of a business, finding the most profitable or most effective scenario.

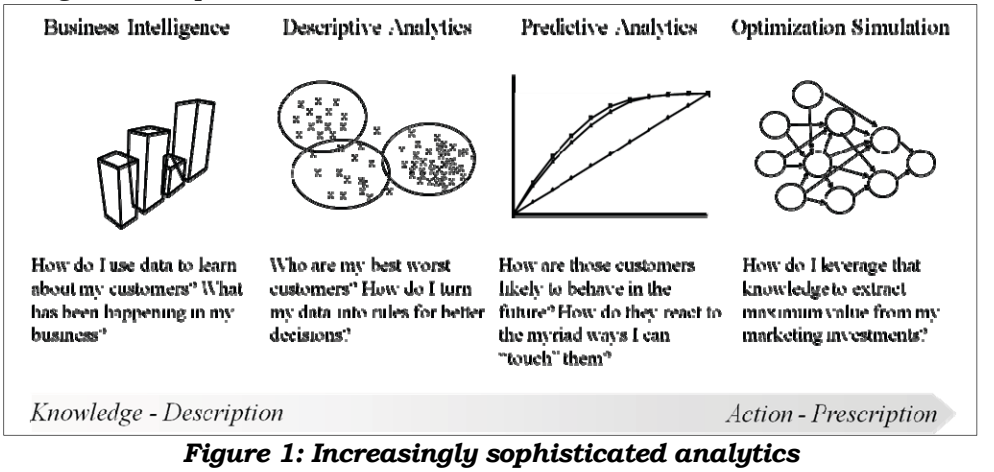

Figure 1: Increasingly sophisticated analytics

Embeddable analytics

More important for the creation of intelligent, automated processes than the increasing sophistication of these analytics techniques, is their embeddability. While business intelligence can be embedded into a process, as in-process dashboards or reports, business intelligence cannot be embedded into *automated* processes. As noted above, there is no-one to look at dashboards, no-one to interpret reports. What we need are techniques that allow someone to develop insight about our data outside a particular process instance and then embed that

insight into an operational decision so that every process instance has access to it.

Instead of relying on the analytic skills of a dashboard or report user, we must create insight that can be used in an operational decision. The results of descriptive analytic techniques can often be embedded represented as a set of business rules or an equation. Predictive analytic models can be described using calculated attributes or equations. Optimization models can be represented as code also and can also drive operational decisions but this is less common in practice. The key tools and techniques for embedding analytics in decisions, and thus automated processes, are therefore those related to descriptive and predictive analytics.

Descriptive analytics

For example, consider data mining or descriptive analytic techniques that result in customer segments or clusters. The classic approach is to take information about customers, including something desirable such as profitability or loyalty, and see which properties of a customer (number of products purchased, time as customer, age etc) divide customers up into groups with a similar profitability or loyalty. Clustering or segmentation techniques create different groups and this can be visualized in a BI tool. But it can also be turned into a set of rules—customers with a specified combination of properties/values fall into this segment while customers with a different combination fall into this other segment. These rules can be executed by a decision service so that the decision itself—which customers to retain and how, for instance—can use the segmentation as part of its decision making process.

Predictive analytics

Predictive analytic techniques are also embeddable. Using predictive modeling techniques one can create a formula that predicts how likely something is to be true—how likely a customer is to churn, for instance, or how likely they are to accept a particular offer. These formulae or equations are hard to develop (at least they are hard to develop if we want them to be usefully predictive) but they are easy to express once developed. They also typically calculate a value, a score, representing how likely something is to be true.

Such an equation can be used to populate a field in a database so it can be used as part of a record. For instance, a predictive model of credit risk can be executed against every customer record, populating a column in the database called "risk score." However, this makes the value static in between updates.

Alternatively a decision service itself can execute the formula or equation, calculating the predictive "score" as it is called and making that available as part of the decision making process. For instance, the decision service can make a different decision for those customers who are more loyal than those who are less so.

By adopting these analytic techniques, we can turn the data we have into insight that can be consumed by automated decision services.

BUSINESS RULES AND ACTIONS

The third issue with intelligent, automated processes is the need for them to keep moving: for them to make decisions take actions and proceed without waiting for human intervention. We may not manage this 100 percent of the time, but we want our processes to move on without intervention as often as possible. Even if we turn the data we have and our understanding of our business into executable insight, we must still act on that insight. A prediction about a customer is not a decision, it is just a prediction. A description of our customer is *part* of what we

need to decide but it is unlikely to be *everything* we need to decide. We must be able to define the actions we take as a consequence, and the action we take must be legal and appropriate.

Decisions need more than analytics

Take an example. We have a process for onboarding customers that needs to support kiosks and website signups—so it needs to be automated. During this process we want to make a decision about cross-sell, up-sell or down-sell—we want to make sure the customer has the right product(s). In particularly we want to drive a decision that will maximize loyalty.

We can build a set of predictive models that allow us to see how likely it is that someone will be a loyal customer for each of our base products. In other words, we can build a model to calculate the likelihood that a specific customer (with these characteristics) will be loyal if he or she buys a specific product. To make the decision about recommending an alternative product, however, we need to be able to take those different values, see if the product the customer is trying to buy is the best choice and, if it is not, decide if the "best" choice is more or less profitable. If it less profitable but boosts the potential loyalty of this customer enough and if we can deliver that product to that customer (perhaps there is a capacity limit on our products), then we may decide to make alternative offer.

To keep the process moving it is not enough to calculate the propensities for this customer, we must be able to act on them. We must be able to define the business rules that determine which action(s) to take.

Don't code decisions

While we could just write code to do this, that would be a mistake. Decisions are often high-change components of a process with many factors causing the rules to change. For example new regulations can be issued or we can change our policy. Delay in being able to change our decisions to reflect such changes may result in lost business or fines.

In addition the logic of a business decision is very much under the control of the business, not of IT. Writing code to implement these rules will make it hard to change them quickly and hard to bring the business into the ownership role for the decision. Instead of writing code we can and should use a Business Rules Management System or BRMS to manage Business Rules explicitly.

Business rules

Business Rules in this context are logical, atomic statements of what can and should be done in different circumstances. Each business rules is independent and can be written, assessed and changed independently. A BRMS can manage all the rules that go into our operational decisions and make it possible for the business to "own" them while still ensuring that IT can manage them. A BRMS is an effective way to automate decisions while remaining understandable by the business. Modern Business Process Management Systems are increasingly delivering an integrated BRMS or providing interfaces to make integration with one straightforward.

In addition to this business control and agility, decision making logic in a BRMS is now explicit. When the decision service makes a decision it is possible to log exactly how it did so—which rules fired, what analytic insight was applied. Not only is this helpful for regulatory compliance, it is also a new source of insight into how our business operates.

More than just analytic rules

While some of the rules in a decision might be derived analytically as discussed above, business rules can also be derived from regulations, policy or experience. Regulations impose restrictions on what is allowed and insist on certain actions being taken in certain circumstances. Similarly company policy or expertise can lead to rules that constrain or drive actions.

Many decisions require a mix of all these kinds of rules. For instance, a loan pricing decision requires rules set by the lender based on its policy and experience, additional rules set by State and Federal regulations, rules about what can and cannot be effectively sold on the secondary market and rules derived from analysis of the current loan portfolio to characterize the proposed loan in terms of likelihood of pre-payment or default. A good decision will use all these rules.

INTELLIGENT, AUTOMATED PROCESSES

Using embeddable analytic techniques, both descriptive and predictive, in combination with business rules allows you to effectively automate operational decisions so they can be embedded in automated processes.

Decision services in the technology stack

As Figure 2 below shows, the technologies required to build decision services fit inside a standard service-oriented architecture. Controlled by a business process management environment and taking full advantage of data and performance management infrastructure, a Decision Service contains the right mix of business rules, descriptive and predictive analytics, and optimization to make the decision for which it is designed.

Adaptive control is an additional step for organizations with more complex decisions to make using decision services. Adaptive control uses test and learn or champion/challenger approaches to constantly test new rules and analytic models against the current approach to see if better approaches are possible. For more details, see Taylor & Raden, 2007[1].

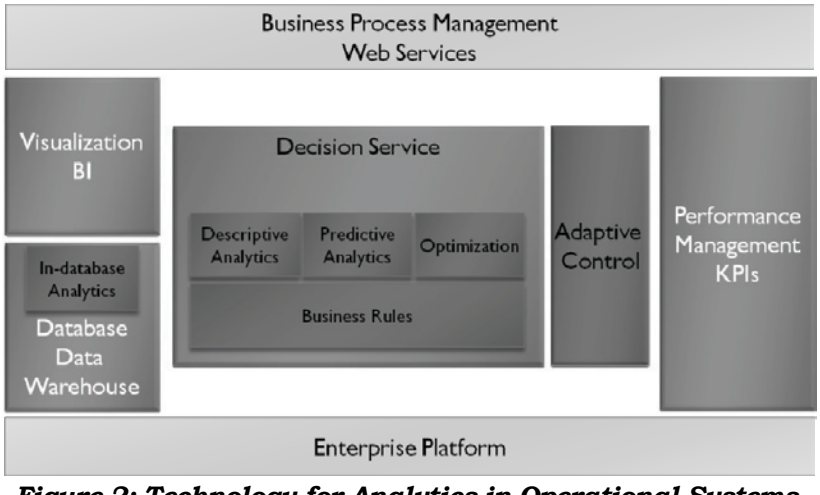

Figure 2: Technology for Analytics in Operational Systems

[1] Taylor, James and Raden, Neil. *Smart (Enough) Systems: How to Deliver Competitive Advantage by Automating Hidden Decisions.* New York. Prentice Hall, 2007.

Getting started

To get started with the approach, we begin by identifying the decisions that will make a difference to our processes and by understanding how they relate to our KPIs. We need to understand the decisions within and about our processes, we need to classify them and we need to put them in context.

When it comes to automating them we must begin with the decision and we must keep it in mind. We will develop analytics that will help with the decision or make it more accurate, we will find the rules that apply to the decision. We will use these analytics and rules to determine the data we need and then integrate and cleanse that data.

- ✓ *Consider business rules and analytics as linked decision-making technologies. There are problems that can be solved by one or the other but the combination is more powerful.*
- ✓ *Always begin with the decision in mind. There is a temptation to create infrastructure across all processes and this should be resisted. Focus on the decisions and drive infrastructure from the needs of those decisions.*

Intelligent, automated processes are not the stuff of science fiction. They can be developed by automating the decisions that are embedded in our operational processes.

Using BPM to Drive Clinical Intelligence and Process Oversight in the Acute Healthcare Setting

Ray Hess, The Chester County Hospital, USA

INTRODUCTION:

The environment of the acute hospital setting is a complex compilation of intricate processes. The healthcare worker is challenged to manage and coordinate many diverse aspects of their patients' care effectively. There is an ever-increasing burden of care options and requirements that need to be considered. The use of business process management to help automate and control patient care has been shown to be effective in improving this care burden. However, the healthcare sector has been very slow to adopt BPM. There are many reasons for this phenomenon. Clinical care processes are very complex and often do not have easily defined beginning and ending points. They tend to overlap and disrupt other workflows based on the details of the individual process. A complex matrix of conditions can change the logic for dealing with event-based data elements and the way a system should react to those events. The clinical users tend to be very mobile and are not electronically connected for extended periods of their day. These are just a few of the challenges facing healthcare process automation.

One of the most daunting hurdles for creating effective BPM solutions in the acute healthcare setting is the ability to understand and map the process flow. The variables involved are very complex and intertwined. Multiple end-users all interact with patients in varied and changing ways based on the specific disease conditions and external variables that are present in the care environment. The challenges are extensive but the need is great. The payoff is significant if automated processes can be developed, deployed, and managed successfully. Ineffective management of processes is a problem that exists extensively in the healthcare arena even when accurate BPM flows are running. This primarily revolves around the ignoring of alerts and action reminders by the clinician. Unlike many industries, healthcare workers cannot always stick to defined work lists and a structured order for the actions they need to take. Situations arise regularly which force a deviation from the planned events. The responsibility for the care is regularly delegated, triaged, and handed-off. The priority of what care to deliver in what order is often in a state of flux. The patient or any patient can cause disruption or delay in following a planned schedule. Finally, the caregivers themselves can represent the problem if they do not act on their electronic directions in a prompt and consistent manner. Many well-developed processes are thwarted by the staff not being consistent and timely in addressing their BPM related alerts and directions.

This chapter will focus on the use of BPM to support Clinical Intelligence Management. BPM driven oversight tools have proven to be a vital cog in the wheel of overall BPM success and improved outcomes in the hospital healthcare setting. Without it many of the processes do not achieve the desired effects. This chapter

will review how the BPM system can be used to aggregate data in an effective manner for centralized oversight and management in addition to the normal expected patient level directives. The use of BPM has allowed The Chester County Hospital in West Chester, Pennsylvania to have a significantly enhanced patient care oversight and control capability. The result of having this capability has been more efficient and effective patient care outcomes.

Healthcare Systems Overview: Systems used within healthcare are designed to provide for patient care and to support clinical tasks. These systems contain functions such as ordering (tests or medications), documentation, and displaying results. The clinical care systems used in today's hospital almost universally have hierarchical database structures and are optimized for transactional activity. This means that they respond very quickly to individual events and actions regarding an individual patient. Examples of this may include: new test results, entering orders, pulling up charted documentation, or entering a clinical note. The systems and their databases are designed and granulated in such a way that the database indexes optimize on a single patient or event data. The goal is very rapid responses for the clinician at a patient level.

While this transactional structure works very well for managing an individual patient's care, it creates significant problems for anyone trying to aggregate data to obtain a more global view of the current status of groups of patients or disease conditions. Attempting to query a transactional database to get this type of data can result in very long query run times, table scans, and possibly system performance degradation while the query is running. Healthcare systems are not designed for relational querying. They usually have functions to export this data periodically to a separate reporting database that is relationally optimized. This is where analysis is expected to occur. Unfortunately, the use of an external dataset does not provide the real-time information needed to oversee and manage care. The data to accomplish proper oversight must be current and therefore must come from the production database.

Most clinical information systems have some level of rules-based clinical decision support capabilities which results in alerts to the clinician concerning proper actions and care options. The most advanced systems are now starting to include BPM in the product allowing for more extensive process management and automation. In all cases these systems are designed to analyze and react to transactions or discrete events related to each patient as they occur. This is very effective for overseeing and directing the care for single patients via the caregivers that are involved in the case. These BPM systems often give basic information about what processes are running, what steps are currently being executed, and what alerts/tasks are currently open. In short, they give adequate BPM oversight related to the BPM system operation and BPM activity monitoring.

The harvested information described in the previous paragraph represents clinical intelligence for an individual patient. This is defined as the knowledge of the aggregate disease conditions, current care status, and what actions should be considered or taken next for a specific patient. However, this type of information does not support the needs of the supervisor or a care specialist who needs to see the aggregate information for a population of patients. Hospitals often have "specialists" who deal with certain disease conditions or types of care such as congestive heart failure, diabetes, IV therapy, wound care, or managing stroke patients. Furthermore, departments such as Quality Management or other operational units need to see global status conditions for compliance with regulatory requirements or quality initiatives. Supervisors need to see if their staff is responding appro-

priately to their assigned work items. None of this is accomplished easily in a traditional BPM process.

The data described above is often collected via tedious manual processes or is gathered from the reporting systems which do not represent current information. This results in information that is often inadequate and/or erroneous. Sometimes the departments settle for the stale data or else they go through time consuming chart reviews and aggregate data in spreadsheets. This results in lost productivity, reduced management capabilities, and sub-optimal patient care. The clinical care specialists and supervisors need timely and accurate information to properly oversee care.

Using BPM to Manage Clinical Information: Historically BPM's use in healthcare has been focused on patient-specific workflows. This is very appropriate but has not always been effective. The BPM processes listen for individual events and react according to the pre-defined logic. The data for the individual patient event is readily available because it is often included within the event. Alternatively, it is easy for the BPM system to query the transactional database for more complete event data since the database is designed for just such a query. The data is reviewed by the BPM system and appropriate actions are taken. At that point the system is normally finished with the data and waits for the next event or action to occur. However, there is an opportunity to alter the BPM process design at this point to harvest this valuable data for increased clinical intelligence.

The first step is to determine what data elements are needed for real-time monitoring of the key processes. These are the elements that exist with each patient but are stored in such a way that aggregation is difficult. It is also important to understand what the data represents and the range thresholds that indicate a problem or item that needs attention. The end-users on the supervisory or specialty level must be engaged in determining these elements. They are the key stakeholders and their input is imperative because they will be using this clinical intelligence to assure that the overall outcomes are positive.

Once the necessary data elements are cataloged a relational database table structure needs to be developed to hold this data. Ideally one table should be created for all the elements needed for any specific process that is to be monitored. However, the most appropriate design will need to be determined on a case by case basis. Next logical indexing strategies need to be developed based on the way the data will be queried. It is very important to understand the differences between hierarchical and relational database structures. Usually this work is handled by a database administrator (DBA). This fact cannot be overemphasized. The person working on this aspect of the project needs to have a solid skill set regarding databases.

After the table structure is created conceptually it needs to be created in the system's database itself. This step should also be performed by a DBA. It is strongly recommended that you create a separate database for the relational table structure you are creating. This keeps these tables isolated from the production database and protects the work from interfering with the existing database or from being overwritten during a system upgrade. If possible try to keep the new database on the same server instance as the system database. By doing this the BPM engine should have no problem interacting fluidly between these databases.

Once this pre-work is done the next step is to alter the BPM processes that manage the workflows these new tables refer too. When an event trigger is fired the BPM process should collect all the data associated with the event being handled.

This data, because it is coming from a transactional system, will be very easy to grab in a manner that does not have any significant time or system impact. As the BPM engine completes its actions based on the existing logic a new sub-procedure is added to the BPM flow. This new procedure takes the data and either adds it to the relational table(s) or updates the current data for that patient in the tables. If the function being monitored is ending or the patient is discharged the BPM process removes the table entry in its shutdown sequence. This clinical intelligence manager sub-procedure is designed to manage only active cases or issues. Historical data will be pulled out of the already existing reporting database in the clinical system.

The result of the alterations to the BPM flow mentioned above is substantial. The system now has small relationally optimized tables that have the current conditions for the entire population of patients, diseases, or devices. These tables represent a compilation of many data elements from the transactional database which is often too granulated and/or non-indexed for real-time reporting. The BPM engine is used to manage the new reporting database for the end-users. It also places information about the status of work items or patient care related processes to the data in these tables as well. The system creates customized BPM managed Business Activity Monitoring for real time oversight.

The final piece of the equation is to create reporting views of these tables for the end-user to query. We chose to use Microsoft's Reporting Services because it gave us the ability to add logic to cells in the report that pulls the viewer to key data elements and because it had no additional licensing fees. Any of the major reporting packages should work and almost all environments have a package in use. Whenever the user clicks on the report a real-time picture of the status of the environment is created for that person. It allows them to see the institution from a global perspective instead of just from a single patient's needs. The data represents the current state when the user runs the query that pulls up the report.

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PINU	331601	IV1	0	R Antecubital	Peripheral IV	Apr 05, 2010	No pain, no erythema	0
PINU	331701	IV1	0	L Outer Forearm	Peripheral IV	Apr 05, 2010	No pain, no erythema	0
PINU	331901	IV1	0	R Inner Forearm	Peripheral IV	Apr 06, 2010	No pain, no erythema	0
PINU	332101	IV1	0	L Inner Forearm	Peripheral IV	Apr 06, 2010	No pain, no erythema	0
PINU	332201	IV1	0	L Outer Forearm	Peripheral IV	Apr 04, 2010	Drainage	0
PINU	332201	IV2	0	R Wrist	Peripheral IV	Apr 06, 2010	No pain, no erythema	0
PINU	332301	IV3	0	R Wrist	Peripheral IV	Apr 07, 2010	None	0
PINU	332401	IV1	1	R Upper Arm	Power PICC	Mar 30, 2010	No pain, no erythema	0
PINU	332501	IV1	0	L Antecubital	Peripheral IV	Apr 06, 2010	No pain, no erythema	0
SCU	W00101	IV1	0	L Dorsal Hand	Peripheral IV	Apr 06, 2010	No pain, no erythema	0
SCU	W00201	IV1	1	R Upper Arm	Power PICC	Apr 04, 2010	No pain, no	0

Figure 1: A portion of a BPM-managed report showing IV detail

Figure 1 shows a good example of how this concept is used in real life at the Chester County Hospital. This is a screenshot of the report that shows every IV on every patient currently in the hospital. The user, in this case the IV team, is charged with overseeing the care of patient IVs. These nurses are able to get up to the second IV information for all patients anytime they click the report. Because this report is coming from the relational tables it returns in at most one to two seconds. The real report is in color. The lighter gray on the black and white image in this chapter is actually yellow on the report. The darker gray is red. Yellow represents current work or issues. On this report there is an IV that needs changed today and one that is missing documentation, both are cells that are in yellow. The red cell is for an IV with an issue that needs attention by the IV team. By adding filters (not seen) the user can instantly hone in on the specifics they need to see. If we had tried to create this report off of the transactional tables it could easily take up to 60–90 seconds to run on the same server.

The implications of this type of information availability are incredible for the hospital. Before this methodology was created the BPM process could monitor individual patients and alert the responsible nurse concerning the IV, specifically when it needed changed or evaluated. It could also send alerts to the IV team when a nurse noted in the documentation that there was a problem with an IV. The BPM workflow was good at the individual patient or nurse work level but not for the global team's oversight. By adapting the BPM process to take the data it was already evaluating to maintain a table of all IVs with their current status global management capabilities were greatly enhanced. The IV team now pulls up this list, uses various filters they have requested, and quickly and seamlessly gets a picture of the IV status for the entire facility. This allows them to prepare their work plan based on pressing needs and real-time clinical intelligence.

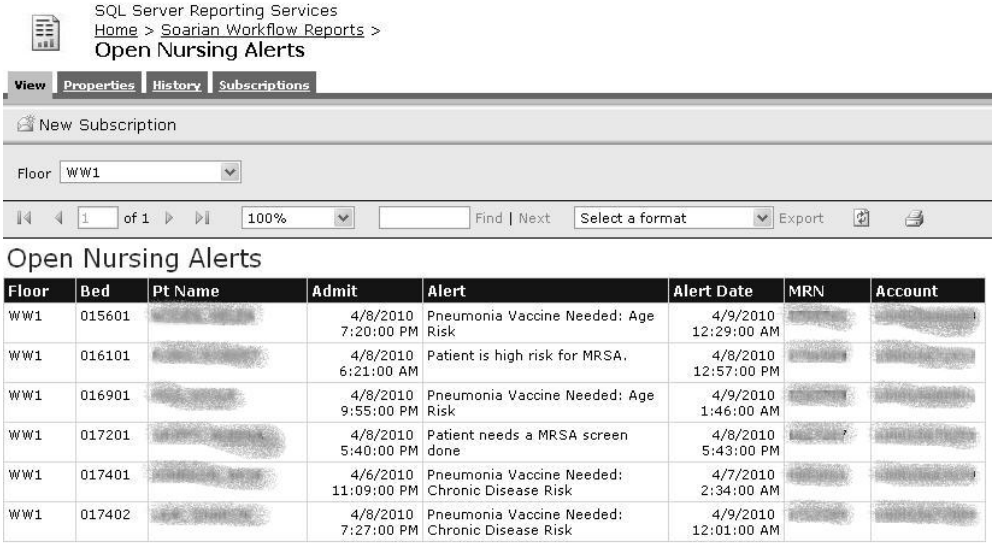
The original BPM process was developed to alert the IV team for specific issues that required their attention. However, by using the formatting logic to highlight and color specific cells in our report the IV team has found that these alerts were often not needed. The report became their worklist and they use it effectively. As the IV teams gleaned information from this global report they were able to see trends and changes that were needed in how the floor nurse documents IV statuses. They requested these changes and education has been conducted with the staff. This oversight has resulted in a steady clean up the accuracy of the source data documentation. This positive outcome was only possible because of the capabilities provided by the improved oversight via this enhanced BPM process. Retrospective analysis from the traditional reporting system, while important, did not give this type of insight and control.

The methodology described above has been used for multiple processes within the hospital. It has been used for devices such as IVs and Foley catheters. BPM managed reports exist for conditions or diseases such as pressure wounds, diabetes, congestive heart failure, and stroke. This methodology has also been used to provide the supervisor staff with exact knowledge of the current work status in their area of responsibility. The BPM engine is being used to manage the management of processes as well as the processes themselves.

Healthcare has had ongoing problems with alert items being ignored by the clinical staff. This has been well documented in the healthcare literature. At the Chester County Hospital there are alerts on hundreds of patients on a dozen floors. The nursing alerts need to be addressed by many different nurses on different shifts. There are hands-offs constantly occurring. Trying to get over 700 nurses consistently all to do the right things 24/7 has proved to be as difficult for this

hospital as it has been throughout the industry. Consequently the BPM automated workflows had been compromised in their effectiveness. The BPM-managed clinical intelligence methodology has provided hospital management with the tools needed to oversee and therefore improve the effectiveness of the BPM processes.

The new approach described in this chapter has proven to be a key in addressing multiple problems. The BPM engine is used to roll disparate alerts from many diverse processes into summary compilations by floor and areas of responsibility. On any given shift there is a supervisor responsible for each of the dozen patient care floors. Each of these supervisors is tasked with reviewing the status of their floor's alerts by the middle of their eight hour shift and having them addressed (whenever possible) by the end of the shift. This management mandate has reduced the oversight burden from hundreds of nurses to 12 supervisors. The nursing manager over these supervisors assures that they accomplish their task. Because the supervisors are on top of the staff and the staff knows they will be challenged for not handling their alerts, the alerts get handled whenever possible. The bottom line has been better and more consistent patient care.


SQL Server Reporting Services
Home > Soarian Workflow Reports >
Open Nursing Alerts

View | Properties | History | Subscriptions

New Subscription

Floor WW1

1 of 1 | 100% | Find | Next | Select a format | Export

Open Nursing Alerts

Floor	Bed	Pt Name	Admit	Alert	Alert Date	MRN	Account
WW1	015601	[redacted]	4/8/2010 7:20:00 PM	Pneumonia Vaccine Needed: Age Risk	4/9/2010 12:29:00 AM	[redacted]	[redacted]
WW1	016101	[redacted]	4/8/2010 6:21:00 AM	Patient is high risk for MRSA.	4/8/2010 12:57:00 PM	[redacted]	[redacted]
WW1	016901	[redacted]	4/8/2010 9:55:00 PM	Pneumonia Vaccine Needed: Age Risk	4/9/2010 1:46:00 AM	[redacted]	[redacted]
WW1	017201	[redacted]	4/8/2010 5:40:00 PM	Patient needs a MRSA screen done	4/8/2010 5:43:00 PM	[redacted]	[redacted]
WW1	017401	[redacted]	4/6/2010 11:09:00 PM	Pneumonia Vaccine Needed: Chronic Disease Risk	4/7/2010 2:34:00 AM	[redacted]	[redacted]
WW1	017402	[redacted]	4/8/2010 7:27:00 PM	Pneumonia Vaccine Needed: Chronic Disease Risk	4/9/2010 12:01:00 AM	[redacted]	[redacted]

Figure 2: Open work items for nurses on floor West Wing One

The management technique of a hierarchical chain of command and responsibility is not new. It is a key to making sure that operations are accomplished properly. In the acute healthcare setting there have been many challenges to effectively automating processes. The use of the BPM engine itself to manage the relational reporting capabilities for effective control has been the key to unlocking the power of the BPM processes at The Chester County Hospital. Figure 2 shows a simple view of multiple alerts that need to be addressed for one floor (patient identifiers have been removed to maintain their privacy). Note that the alerts are from different processes. These alerts are the responsibility of multiple nurses but all fall under one supervisor who will make sure they are addressed in an appropriate manner. It was actually hard to find a good example of this report since there were few unaddressed alerts available for any given floor. The example shown has no alerts older than the threshold established that would have changed the color on the report.

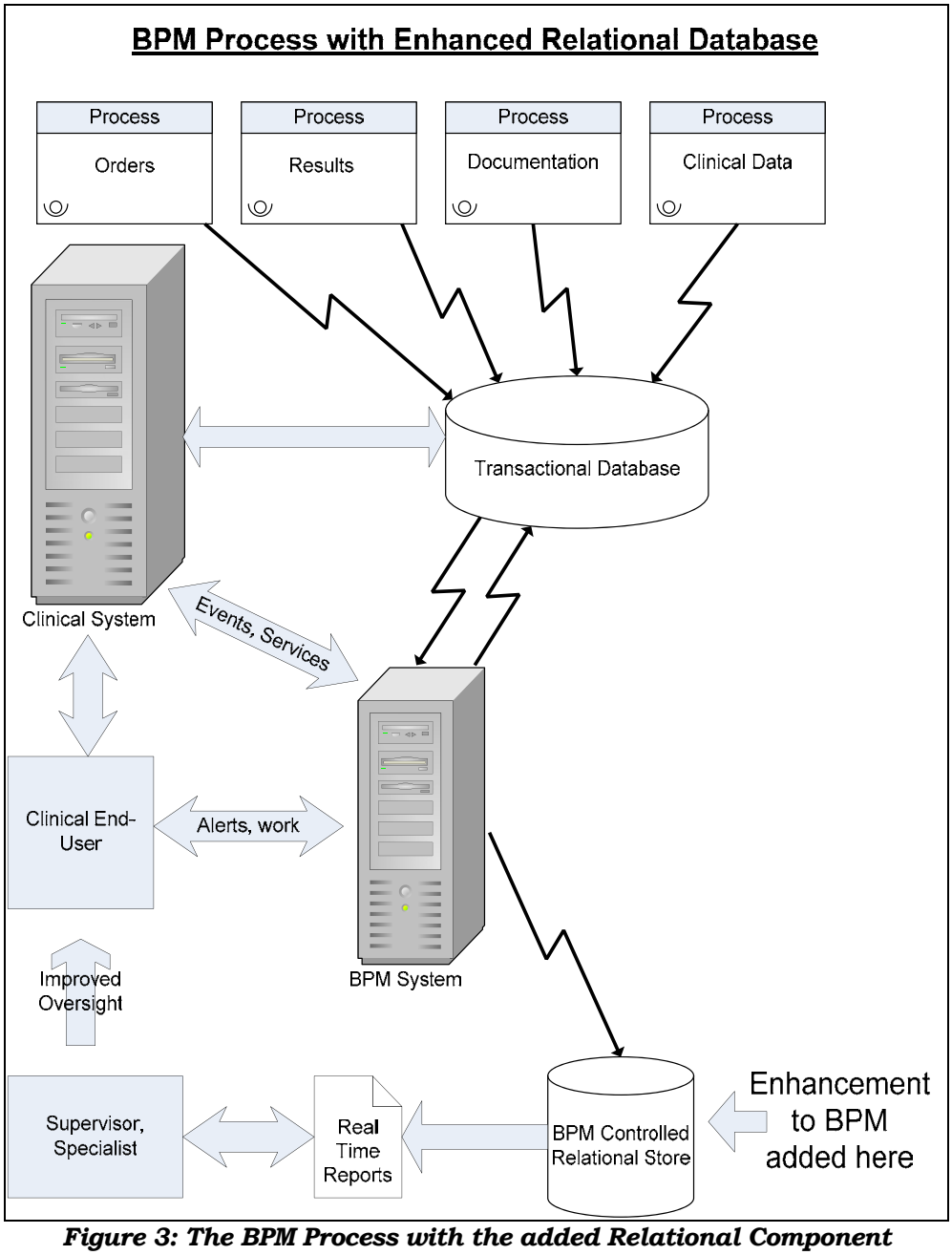


Figure 3: The BPM Process with the added Relational Component

Figure 3 shows a visual representation of the basic BPM schematic. The boxes across the top of the diagram are examples of internal and external data events that occur in the clinical information systems. These processes may be end-user initiated, system initiated, or come from external sources. The clinical system processes the data, stores it in the transactional database and sends out events and updates. The BPM system subscribes to the events and calls services to retrieve data from the transactional database. Using the data obtained, the BPM system creates alerts and work for the end user who is interacting with either the clinical system or the BPM system. These actions are all patient centric. The enhancement is graphically represented at the bottom of the picture. The BPM sys-

tem manages a relational database which is used to create on-demand real time reports showing the current state of affairs. These reports are used to provide better control or oversight for better outcomes.

The use of the BPM engine to manage a relational reporting database in a hierarchical environment has created many diverse opportunities for the hospital. The key advantage it has provided is that it has given a method to aggregate disparate data elements into focused clinical intelligence. In the healthcare environment the term "clinical intelligence" is correlated to "business intelligence" in other sectors. These data elements are extremely valuable for individual patient care but now they are leveraged in new and exciting ways. As stated earlier, this capability has dramatically improved the ability to oversee and manage the care delivery within the institution.

Non-Healthcare Application: The process described in this chapter was applied in a healthcare setting. However, the concepts should be applicable in a wide range of industries and scenarios. If the industry is functioning in a transactional world and is having problems obtaining and controlling business intelligence the BPM engine should be considered as a possible way to address the problem. It is a powerful tool that is already handling the data as it manages automated workflows. Most high-end BPM systems have very robust database interaction capabilities. There is almost always an existing reporting package that the company is using and it can be formatted to present the data. The industry details may change but the core functionalities are usually very similar. Therefore it should be fairly straightforward to replicate this type of methodology.

There are four key knowledge-sets that are required to create this type of solution. The first is a DBA (database administrator) or someone who can work effectively within the database associated with the system. The second is the BPM process engineer who has the knowledge set necessary to alter the process flow for this task. The third skill set is that of a report writer. This person needs to know how to create effective and focused reports from the created tables. The final requirement is the most important and can often be overlooked or minimized. This is the key management or knowledge experts who can define the precise items needed for effective Business Activity Monitoring. Without their input the other resources will not know what is needed to assure success.

Achieving this type of solution is easiest if it is planned for during the initial BPM process definition. In the hospital's case the need became apparent because of the inconsistent way the staff handled their alerts and work items. Key existing automations were reworked based on priority. Once the initial wave of modifications were made and tested, the power and importance of this new approach was clearly demonstrated. From that point forward this new methodology was incorporated into most of the process automation projects that were already in development and is a standard part of all new work that is being started.

In conclusion, the Chester County Hospital has been able to effectively use the BPM engine to manage relational reporting structures in a hierarchical database environment. By using this approach the hospital has been able to obtain aggregated information that has significantly improved its ability to oversee and manage key processes. As stated earlier, the BPM engine is being used to manage the management of processes as well as the processes themselves. This methodology should be applicable to other industries if the industry is having difficulty in obtaining key business management information and/or views on a real time basis.

Enterprise Process Automation– Providing the Gift of Time

Roy Altman, Peopleserv Inc., USA

PREMISE

I recently embarked on a project to improve Human Resources processes for a client. My methodology was to interview stakeholders from various points of view, from line-level managers through executives, globally. Following the interviews, I presented my observations, findings, and recommended actions. Toward the conclusion of the discovery phase, I was interviewing a senior executive from the London office; one of the highest ranking women in the financial services industry.

My parting question: "What would bring you the most value?"

She replied: "Well, more hours in the day!"

My initial inclination was to put her on a supersonic jet flying westerly, so she could be constantly gaining time each day. But after considering her statement, it occurred to me that if we could eliminate the work that can be effectively automated, it would have the effect of creating more time, and the added benefit of being able to use that time for tasks more enjoyable for the worker, and more of a value-add for the company. I called the resulting action plan: *"Enterprise Process Automation."*

OBSERVATIONS & CONCLUSIONS

My observations about this client, and many clients that I serve, was that work is disorganized. Too much time is spent doing administrative tasks. There were too many manual touch points of information. The company had many software applications in house, but they weren't integrated well. Often, Excel spreadsheets are used to bridge the gaps between point solutions. Thus the information was changed outside of controlled processes, and then uploaded into the next point solution. The solutions, therefore, worked in silos rather than as a well-integrated whole. Yet the end-to-end business processes involved touch points in several systems, so they were screaming for better integration. Procedures weren't well defined. Often managers didn't know what system to use to get the information they needed, or how to use that system if they did. Each system, in addition to having a URL starting point, required a userid/password to access. These were often forgotten or misplaced. In desperation, managers would ask their HR generalist to access the information they needed, which meant that HR was bogged down with administrative work and couldn't concentrate on being a partner to the business.

Employees are also experiencing media overload. Emails are used as the primary means of disseminating information or requesting that an action be performed. Most of the point solutions in the enterprise had an automated workflow component, and each of these prompted for an approval by sending an email. As a result, most managers received hundreds of emails a day. Sending an email to a busy manager is akin to casting a twig into a fast-moving stream from a bridge. The twig is swept away before it can be consi-

dered. Thus emails containing important information, or requesting approvals in an automated process, were buried before they could be acted upon.

Compounding this problem is instant messaging, text messages, and constant phone calls which effectively act as an interruption scheme when a prioritization scheme is needed.

The net result is everybody is working longer hours, less work is getting done, the quality of work suffered as deadlines are in danger of missed, and workers are constantly stressed, which leads to mistakes and low morale.

RECOMMENDATIONS

The recommendation was to implement a process portal. The portal focused on the end-to-end business processes, not the systems that are involved with automating parts of those processes. Thus the portal was to contain links such as: "Compensate my team" or "Promote an employee" rather than naming the compensation system or Human Resources Information System (HRIS) that actually processed those transactions. Single sign-on was to be implemented, which was integral in making the process-orientation seamless. The portal was to include personalization, so that when a user logged in the system knew who they were and what functional privileges they were entitled to. Pagelets on the portal were reserved for important announcements, and targeted based on the person, so that those informative emails wouldn't get lost. Finally, the portal was to contain an integrated worklist, so that all actions and approvals required of the employee would appear in one place and could be prioritized. The portal, implementation methodology, and underlying technologies comprise Enterprise Process Automation.

ENTERPRISE PROCESS AUTOMATION

Enterprise Process Automation (EPA) is a plan of action whereby existing assets in the company are harnessed to make work easier, allow work to be done faster, and with more accuracy, and more accountability. This is accomplished by using these assets in a more logical way, and focusing on the end-to-end business processes rather than the systems required to accomplish each part of a task. The design imperatives inherent in EPA are:

- ***Flow-through processing:*** Information is only entered once. Reentry of information is not permitted. Once information has been entered and validated, it will flow through to each asset requiring that information automatically.
- ***Minimize mouse clicks:*** Each task is accomplished using a minimum number of steps. No extraneous mouse clicks are permitted.
- ***Information remains in controlled processes:*** All steps in each process occur in controlled processes: information does not leave a form where it is part of a centralized system. For instance there are no downloads to Excel spreadsheets for processing; only reporting.
- ***Interfaces are automatic:*** Intervention by IT is not required to initiate interfaces between systems. Whether an interface is real-time, near real-time, or scheduled is a design decision. However interfaces occur when they need to occur in order to accomplish the end-to-end business process.

- ***Complete audit trail:*** All transformations of information, including but not limited to transaction initiations and all approvals, are stored in a system which can be reported on when needed.
- ***Emails are used only for notifications:*** Approvals are not accomplished by emails, but by controlled workflow processes. This provides the persistence necessary to ensure that the approval is acted upon.
- ***Existing assets are leveraged to the greatest extent possible:*** EPA is a methodology, not a software product. A company should use software assets that currently exist in the enterprise where possible. The objective is to use existing software better, not create extensive new software initiatives. However, there are instances where a necessary software tool is missing and must be obtained.
- ***Manage worker relationships:*** An organization is like an organism in that it is constantly changing. Workflow recipients and business rules require a comprehensive and up-to-date understanding of all of the worker relationships in an organization. The section on People Relationship Management will discuss this in more detail.

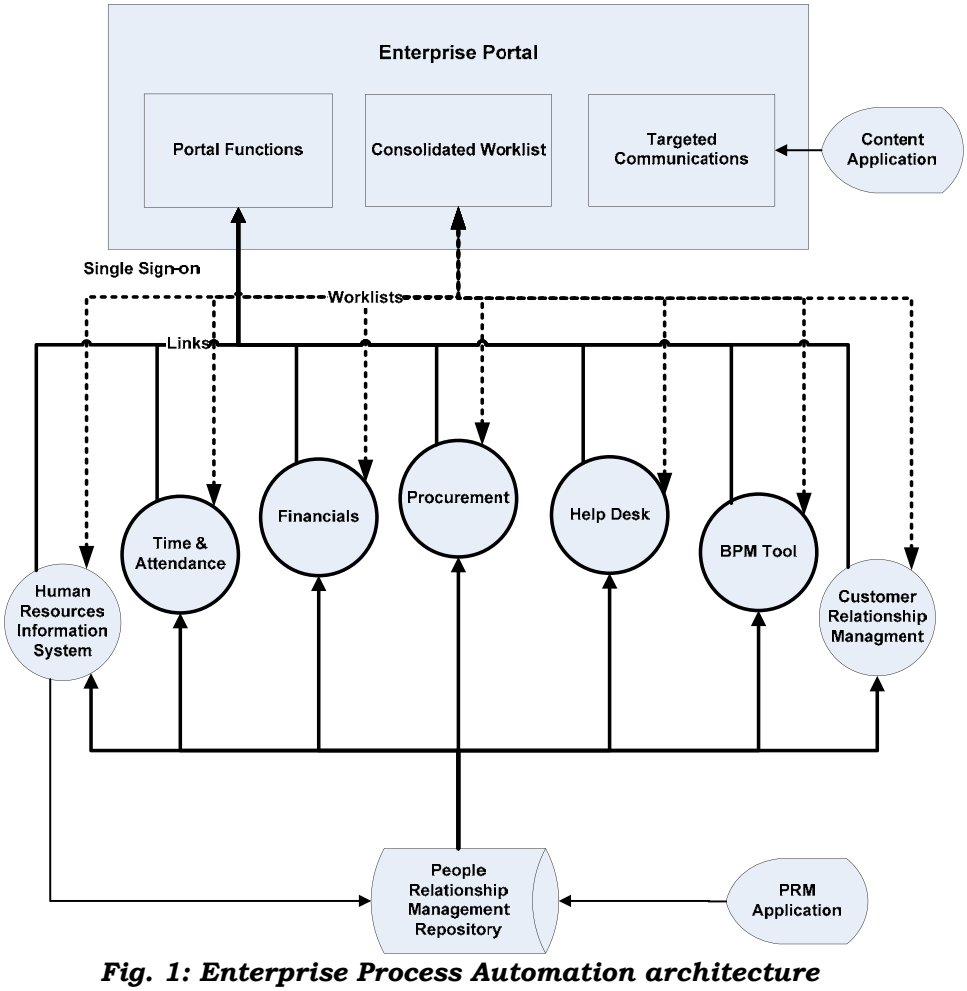


Fig. 1: Enterprise Process Automation architecture

BENEFITS

Since EPA promised the "Gift of Time," it is appropriate to enumerate the time-saving opportunities and other advantages:

- Tasks using workflow complete faster
- Work is managed better on a consolidated worklist
- Time saved locating the place to get the needed information and hunting for passwords
- Time saved searching for the email that you need to complete a task
- Consolidated and complete audit trail of all decisions
- Enhanced data quality due to flow-through processing

COMPONENTS OF ENTERPRISE PROCESS AUTOMATION

The necessary components of Enterprise Process Automation are as follows:

The Portal

A portal is a Web page that contains a link to each "business process" that a user performs. The portal should be "process-oriented" so that the user needn't be aware of the software behind the link that's processing the request.

Single Sign-On

Single sign-on is technology whereby the login credentials are passed to each software application, so that the user needn't remember the logon id and password of each software product. Not only does this allow seamless access to system functions, but it actually *enhances* security because the passwords for multiple systems are not scrawled on scraps of paper and left around the office.

Point solution application software

This is all of the application software used in the enterprise. This includes, but is not limited to: Enterprise Resource Planning, Human Capital, Payroll, Financials, Workforce Management, Talent Management, Help Desk, Customer Relationship Management, etc. There are many best-of-breed solutions on the market for any conceivable application, and each usually contains its own workflow engine, whereby transactions are routed to appropriate parties throughout the organization. Many have their own portals. Thus, each point solution views itself as the "Center of the Universe" in that it should be the controlling point for all activities in the organization. This ethnocentric approach rarely serves the best interests of the corporation. The problem is that business processes span across the "gaps" between what the point solutions provide. The gaps are bridged by knitting together the services involved in a process with workflow.

It is clear, therefore, that the "universe" has no center (just like the time-space universe). Enterprise Process Integration can be viewed as the unifying element in the corporate "universe."

Automated workflow

As stated earlier, each application point solution has its own workflow engine. Some are more robust than others, but each serves the needs of its own business problem. Typically, workflow is used for approvals of a transaction, although it can be used for collaboration on a process. Workflow is often initiated by an email. The problem with emails is that we receive too many of them to be effective. Emails are not prioritized, so we don't know

which are important and which are part of the "noise" that engulfs us during the work day. Therefore, there is no way to control a process initiated by an email. The other way workflow items are organized is on a worklist. In a worklist, items can be prioritized based on due dates. Aging algorithms can ensure that the workflow item is acted on in a timely manner. Thus the process can be controlled in ways that it couldn't when initiated by emails alone. The problem with the worklist is that it exists in each point solution, so the user needs to know to access that application to check his worklist. When a user accesses several systems each day, this adds to the burden incumbent on the user to get their work done. Often, emails are used in conjunction with worklists to cover both bases. Emails are useful, however, as notifications, but not to be relied upon to control events.

"Umbrella" workflow

Although each silo has its own workflow engine, sometimes it's important to have an "umbrella workflow" engine – so that the touch points that fall in the gaps between the silos are covered. In order to do this, one must choose the most robust workflow engine available. Most point solutions have workflow engines that are specifically geared toward the process served by the application. ERP software tends to have fairly robust workflow engines. BPM tools generally have the most flexibility.

Consolidated worklist

A portal presents the user with a process-oriented view of his work. In this view, the user needn't be concerned with the system behind the link servicing parts of the business process. In like fashion, the portal should have a consolidated worklist, which contains items from all of the applications that have a workflow component. Thus the consolidated worklist acts as an electronic "to do" list, containing all items requiring the user's attention. This can then be prioritized to maximize use of a busy executive's time.

Service Oriented Architecture interfaces

A service-oriented architecture is a general term for the use of integration technologies based on widely-accepted standards. Thus, architectures can be designed so that functions within system are accessed as "services" rather than as an entire system. This very much lends itself to the portal approach espoused in this paper. Each business process presented on the portal can access services from within the point solutions that provide a set of functions involved in the business process.

People Relationship Management

People Relationship Management (PRM) is a class of software that maintains the relationships between assets in an organization (I say "assets" rather than "people" because they don't have to be human assets), and stores them in a central repository. Think of it as "Swiss Army Knife" software, a tool that can be applied to a myriad of problems. Since workflow connects people in automated processes, it's critical to identify the right people. Enterprise software (EPR, HR, etc.) only stores one company hierarchy which must be used in all business contexts. This is clearly not aligned with the business processes. For instance, the person who would approve a promotion may not be the same person who would approve a purchase or sign off on an audit. Thus, when automating these diverse applications, implementers often modify the corporate structure to fit their application. So the "master" copy is stored within the point solution, and not in a system-of-record repository,

which is sensitive to changes in the workforce. Even if the workforce changes are manageable, the solution wouldn't scale to the enterprise level. Processes that are automated on a limited scale often identify the individual actors in a process, rather than abstract out to their role. For instance, new hires are routed to Cheryl, the recruitment manager, for final approval. If the company subsequently acquires a company overseas, who has a recruitment office in each country, the system needs to know who the recruitment manager is in each country. Using PRM, the automated solution could be applied to all offices immediately, thereby assisting in streamlining the merger process.

Without PRM, the possibility of broken business processes exists, if the correct recipient of a workflow item cannot be identified due to movement within the organization. Without the ability to assign business rules to groups of employees, an application needs to be implemented to handle each individual case. For example, a company can have different sales commission plans based on location, and different equity grants based on salary grade. In order to automate this, one would need to segregate groups of employees based on salary grade for the equity grants, and location for the salespeople. PRM would handle both situations without any custom code.

THE PORTAL

Evolution of portals

In the early days of the Web, portals were merely a collection of disassociated websites. As portals evolved, they took on a consistent look and feel, added personalization and search capability, and implemented single sign-on to many of the applications behind them. Thus, the portal knew the user logged in, their access rights, and their preferences. For instance, if a user signed on to the portal, it may display the Employee Self-Service transactions available to her, relevant stock quotes, and the weather in her home town. Still, the portal remained folder-dominated, meaning that she needs to know what she wants to work on, and how to navigate to the appropriate link. Current portals are more process-oriented, in that they are able to integrate the back-end applications to automate the end-to-end processes.

As they continue to evolve into more intelligent assistants, future portals will have the ability to anticipate the actions of the user by learning her work habits.

Personalization

A portal should have a degree of personalization. This means that when a user logs into the portal, the portal knows who she is, what her interests are, and what she's authorized to do. The portal should display links to all functions authorized. It may contain a prioritization scheme, whereby more commonly used functions float to the top of the list. Regardless, the links should have a *process* orientation rather than a *function* orientation, which means that the user shouldn't have to search among layers of menus to find the next function in the process. For example, a process can be: "I'm having a baby," which may comprise the following functions:

- Apply for FMLA
- Apply for State Disability
- Check company maternity and baby bonding leave policy
- Update my employment status
- Change my medical insurance coverage

- Change my dependents and beneficiaries
- Reassign my tasks to others
- Have my correspondence forwarded

A person who is in the late stages of pregnancy cannot be expected to know all of the options and steps involved in the process. The portal should guide them through all of the steps, posting worklist items for the steps that can't be concluded in the initial transaction.

Many portal products separate personalization from security, which means that the portal can display a link, but when the user takes that link he is informed that he doesn't have the proper authorization to perform the function. This is a suboptimal practice, which can be mitigated by using People Relationship Management to synchronize security with personalization.

Using single sign-on and deep links, the user is secluded from the system fulfilling the step in the business process. This can be useful as the company migrates from legacy systems, in that the link to the user remains the same even though the underlying system is changing as needed.

One of the challenges is that point solution software sometimes does not provide the deep links into the target sub-process, just a link to the solution's home page. Vendors should be apprised of the EPA strategy and encouraged to provide deep links, or ways to expose services through SOA-based methods. If not available, organizations should provide a link to the home page of the application.

Targeted communication

In today's global companies, enhancing communication is one of the greatest challenges and opportunities to convey a sense of common purpose to associates separated by great distances.

Remember how emails are swept away like a twig in a fast moving stream? Well, many of those emails contain important announcements that should not be ignored. A portal should have the ability to display targeted information to the user. Think of it as "emails with stickiness." For instance, if an employee is in the United States and benefits open enrollment is from November 1–15, there can be an announcement to that affect on the portal. However, a UK employee needn't see that announcement because it doesn't apply to him. Similarly, information pertinent to a specific business unit, job function, or even project team can be displayed as appropriate. This requires that a person administer the content for each interest area. It is important to identify the person with ownership of the portal content for the interest area, and secure his cooperation.

Consolidated worklist

The ideal state is to have a consolidated worklist because it becomes an electronic to-do list for all tasks required of a worker. This eliminates the interruption factor: when you are working on one thing and are interrupted in order to address a higher-priority item. This renders for naught any attempt at organizing the work efficiently. In the perfect world, all business process would be automated through workflow, and all workflow items would be able to be integrated so that they can be controlled on a consolidated worklist. Then, business rules can be applied to the worklist so it can be prioritized to maximize the worker's attention.

However, we know that the world is not perfect. Vendors are less likely to expose workflow items as Web services as they are more common interface items. Therefore integration of workflow items into a consolidated worklist may be difficult. Integration can occur at the data level, rather than the process-level, but that requires an intimate knowledge of the data model. In the worst-case scenario, a process can monitor the company's email server, and compare "from" address to a table that can identify the item as one that should appear on the worker's consolidated worklist.

Integration with the consolidated worklist is even more complicated than that. The first problem is inclusion of all of the necessary items. The second problem is their removal. There are basically three options as far as this is concerned:

- **Remove the worklist item as soon as the link is taken.** This ensures that the item is removed, but does not ensure that the item is "worked." You can include a link on the approval function to re-add the item to the worklist if the work on it isn't concluded.
- **Deep integration with the point solution.** This would involve a two-way Web services integration with the point solution, whereby the software would send a message to the portal to remove a worklist item once it is worked.
- **Allow the user to remove items when "worked."** This involves providing a way for the user to explicitly indicate when an item is worked.

Portal Architecture

There are many options for a portal. The major ERP software suites include a portal product. Middleware vendors provide portal products which are usually based on the emerging BPML standard. If you were to opt for this platform, BPML might be a choice for the "umbrella-workflow."

However, something as simple as a Web page with some code behind it can serve the purpose quickly and easily. An important consideration, however, is that regardless of the approach, the PRM is essential to categorize workers and to provide dynamic personalization and security.

CULTURAL CONSIDERATIONS

As with any change, the cultural challenges are often greater than the technical ones. Moving toward an automated enterprise means embracing the self-service methodology, where managers are empowered with ownership of their information. However, not all managers see it that way. Sometimes, managers are used to having administrators or their HR reps process transactions for them. They don't necessarily see automation as helpful to them, because it requires more action than was previously required. It is necessary to get buy-in from all stakeholders if the new methods are to be adopted. This is best accomplished by inclusion of the stakeholders at all stages of the discovery and implementation process.

EXECUTIVE SPONSORSHIP

The most important aspect in easing the cultural adoption curve is to obtain executive sponsorship up front. Enterprise Process Automation is the realization of a strategy through the tactics espoused in this paper. It should be a C-level executive who decides to enact such a strategy. Having a clear

mandate from the CEO's office will do wonders to mitigate resistance to adoption.

MEASURING SUCCESS

It is important to measure and document the results of the project, in order to validate, make adjustments, and create a business case for progressing further down the road. Collect and publish the metrics identified in earlier phases. For those benefits that are not quantifiable, distribute post-implementation surveys to the stakeholders. This will serve to reinforce buy-in and gain important insights as to how to serve the business even better in subsequent phases.

MATURING WITH THE PROCESS

As more business processes are added to the portal, and workflow items added to the consolidated worklist, the convergence of work processes and information will reach a tipping point, and the portal will rapidly gain in importance and evolve into a hub of information and activity. The result will be an ecosystem of services available through integration technologies, and linked by workflow to humans, who make the nuanced judgments. Lifting the administrative burdens from the process will enable workers to focus on optimizing their decision-making. Thus, workers become more "human" because there is an increasing focus on the tasks for which humans are required. This will result in maximal use of resources for the company and maximal job satisfaction because the barriers to productivity are removed.

Once the pain points are mitigated, we can concentrate on ways to optimize talent by applying advanced analysis. An example is organizing tasks to maximize attention levels.

Companies typically evaluate software products based on the cost savings and risk mitigation that can result from them. However, the use of EPA with PRM offers an opportunity to change the way we manage. *An organization is a group of people who work together to produce value.* Business Process Management software has focused on the processes, but the process cannot be separated from the participants. Better understanding of the way people interrelate in an organization can drive a radical shift in the way relationship-based assets are managed; and provide illumination into the way humans interact.

CONCLUSION

The techniques espoused here are by no means a "magic wand" which will cause all problems in the enterprise to disappear. Try as you might, magic just won't work. Despite notable controversy, reengineering business processes is still more art than science. And like an artist, one should try to perceive the negative space in a business process—the aspects that should be there but aren't, and the aspects that are there but shouldn't be; and seek to make that perception a reality.

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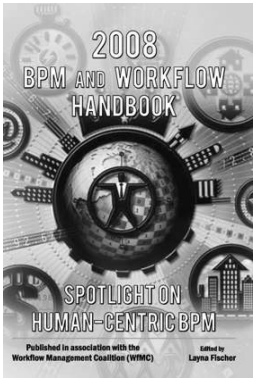

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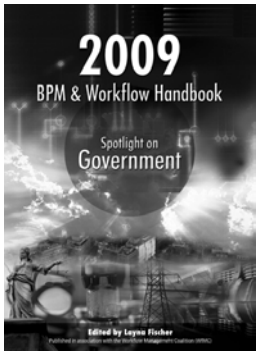

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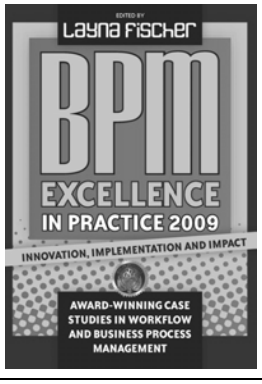

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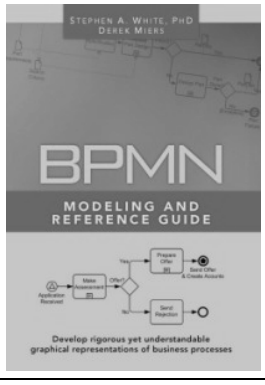

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