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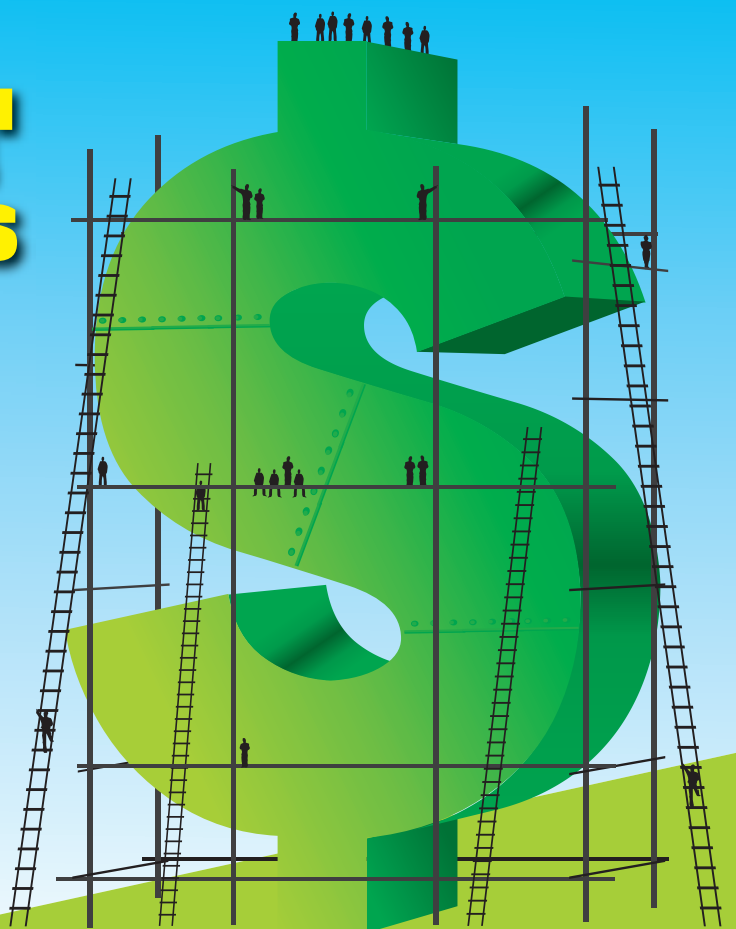

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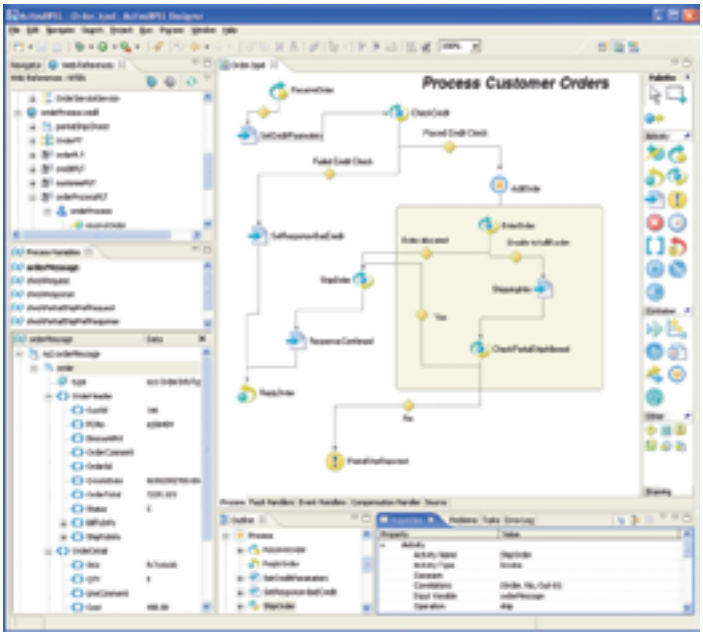

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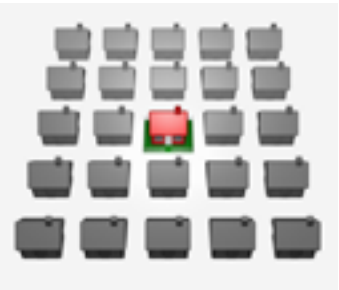
(Over) Due Process

WRITTEN BY **SEAN RHODY**

Sometimes it seems like it takes forever for new technology to be adopted, and even when a technology goes mainstream, it seems as if people cling to the old ways long after a better way has been shown. Heck, I drive a car but still have a couple of horses – sometimes you just want the old and familiar around.

Most of us are familiar with the famous Gartner Hype curve as well, which describes the adoption of a new technology in phases, from the build up of talk about a new standard (the start of the hype), through early users to widespread adoption. I suppose the steady state shown at the end must eventually decline as technologies are made obsolete, but I've never really heard of the opposite – the technology replacement curve, as it were. Sometimes generations have to pass before the technology can be put out to pasture – think about how much COBOL code is still around. What can be interesting is – as a technology reaches its sunset years and the number of people who know it decreases, there's a brief flare at the end of its life where the expertise is hard to find and once again people are paying high rates for talent in what is now an obsolete technology.



Sometimes, a technology seems like a logical, natural fit, but for one reason or another, it doesn't gain traction immediately, even though it makes perfect sense. Part of this is due to the nature of our information technology environments. They're not green fields, waiting to be developed. No, they're more like housing developments, some of which are new, some which are rundown and blighted. A new technology is like a developer wanting to clear an existing track of houses to put up new condos – sometimes the people in the existing houses don't want to sell.

Service management, including Business Process Management, is experiencing just that sort of adoption lag. Existing approaches to the problems addressed by BPM and service management are the low rent district of the IT world. BPM represents the new waterfront condo with the football stadium. Something big, shiny, and new, but with a lot of details to work out, and a lot of political maneuvering to make it actually happen.

Business Process Management provides the ability to model and implement business processes composed from services – a clearly desirable feature in the world of service-oriented architecture. It makes it possible to orchestrate the complexities of an end-to-end process through the myriad of systems that support a business. While that is undoubtedly a good thing, corporations have been making do without it for decades.

At first the technology wasn't available. Then, applications were developed in isolation, requiring manual intervention and annoying workarounds to actually implement a business process. But by and large organizations learned to cope with the non-integrated nature of their business applications.

BPM promises to change that, on top of a service-oriented architecture framework. The challenge is that we're talking large-scale replacement in order to fully achieve the vision.

Short term, we're seeing an approach to stealthy adoption that is common in the software industry – bundling the capability into other products until it becomes ubiquitous. This approach has already worked wonders for service-oriented architecture. As more and more package vendors adopted Web services as their basis for communication, the barriers to entry dropped and it became easier to use SOA then to avoid it. BPM is making inroads by being bundled into packages as well, and by targeting subsets of the market, like service management and service monitoring. As companies begin to use those tools to manage their environments, and learn the power of a process-driven infrastructure, the adoption of BPM will finally get over that hump in the hype curve. ■

About the Author

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Understanding SOA Architectures and Models

The SOA reference architecture PART2

WRITTEN BY **DAVID S. LINTHICUM**

While there are SOA reference architectures all over the place, including mine, the best known SOA reference architecture is defined by OASIS. Here is their definition, albeit a work in progress:

"A reference architecture is a description of how to build a class of artifacts. An architecture describes how to build a particular artifact. The appropriate way to write the description for a reference architecture depends on the particular artifact. For example, you could describe the properties of the artifact. Another way is to write a set of steps (e.g., a recipe) for building the artifact. You could decompose the artifact to an appropriate number of components and subcomponents.

The SOA reference architecture (RA) provides a bridge between the concepts and vocabulary defined by the SOA Reference model and the implementation of a SOA. The SOA reference architecture models the abstract architectural elements for a SOA independent of the technologies, protocols, and products that are used to implement a SOA. Some sections of the RA will use common abstracted elements derived from several standards."

I have to agree with this, albeit it is a bit confusing. They are describing a high level of abstraction to define a SOA, the "reference architecture," and the "architecture" as an instance of a SOA. I get that. However, the larger issue is the fact that the problem domains I'm seeing are not as similar as you think, thus the question is: Can you define a single class of artifacts, and thus provide a sound "jumping-off-point" for the instance? I think a few use cases will prove this out. I could not find many, so send them to me if you have them...I'll post them here. However, to be fair to the creators of the standard, this is still a work in process.

Also confusing is the number of SOA reference architectures you see out there, including this one from Web Methods: http://www1.webmethods.com/PDF/whitepapers/SOA_Reference_Architecture.pdf.

What's more, you can find more vendor-created models going by different names, but basically attempting to define the same thing...a reference architecture for SOA. However, most appear to define the same notions as put forth with the SOA Reference Model (discussed next).

Here are some others:

- Burton Group SOA RA:
  http://www.burtongroup.com/coverage_areas/web_services/architecture.asp
  http://www-128.ibm.com/developerworks/websphere/techjournal/0602_col_woolf/0602_col_woolf.html (Fig. 2)
- IBM SOA RA: http://www-128.ibm.com/developerworks/products/newto/reference.html
- BEA (+ some consortia) SOA RA:
  http://dev2dev.bea.com/2006/09/SOAPGPart1.pdf
  http://dev2dev.bea.com/2006/09/SOAPGPart2.pdf
  http://dev2dev.bea.com/2006/09/SOAPGPart3.pdf

Some of the key issues, as I see it, are:

There really needs to be some fundamental discussions about the use of the Reference Architecture and the Reference Model in the real world. Based on what I found out, as an outsider, there seems to be an impedance mismatch between the way the architecture and model is defined and what's currently going on in the world of SOA. I'm assuming that will "self correct" over time.

It's unclear as to how all of this reaches up into the domain of the enterprise architecture... perhaps not as a replacement, but an augmentation. If so, how do we approach that considering the other frameworks employed?

Like many written standards, the approach is somewhat confusing. Not that the standard itself is bad. I don't think that's the case; but it's difficult for those tasked with building a SOA to see how it will mesh with their current architecture and their current thinking. Over the years I've found that to be as important as good concepts. ■

About the Author

Dave is the CEO of the Linthicum Group, LLC, (www.linthicumgroup.com) a consulting organization dedicated to excellence in SOA product development, implementation, and strategy. david@linthicumgroup.com

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Master Data Management Meets SOA

A SYMBIOTIC RELATIONSHIP

WRITTEN BY **JOHN KALOGIROU**

Master Data Management (MDM) is often defined as "management of master data (customer, product, supplier, etc.) that is shared across disparate IT systems and groups." However, this simplistic description doesn't do justice to the complexity of the MDM's task and problem area. Master Data Management encompasses areas such as Customer Data Integration (CDI), Product Information Management (PIM), and Global Data Synchronization Network (GDSN); and partially overlaps the areas of Identity Management System (IdM), Business Intelligence systems, data quality, and data integration. This broad area of potential application causes multiple perspectives, diversity of stakeholders, and a fair amount of confusion across clients investigating an MDM solution.

The business need for MDM is made manifest both implicitly and explicitly. Its utility tends to be obvious in efforts around conformance and auditing, accurate reporting efforts, and a single view of the customer initiatives. However, MDM is often also a hidden requirement for successful consolidation projects after mergers and acquisitions. Its value in terms of return on investment, cost savings (reduced storage, reduced analysis, development, and maintenance, etc.), increased revenue (consistent view master data, reduced time to resolution, and effective decision making), and competitive advantage (operational efficiency, improved visibility to company performance, etc.) has been well documented by multiple reputable groups and authors (AMR Research, Forrester Research, Gartner, and the Yankee Group) so we won't explore the existing benefits that the reader can easily reference. We will however discuss the benefits of MDM as they relate to SOA enablement.

MDM systems can be "federated," "integrated," or "hybrid" reflecting a combination of the first two fundamental architectures. These three types of system characteristics are as:

- **Federated MDM** – cross references key identifying information from participating systems to implement a registry-style solution. The main benefit of a federated solution is non-intrusiveness on participating systems that maintain their original context.
- **Integrated MDM** – stores all master data information from all

participating systems in a centralized MDM repository. This centralized repository houses the "gold copy" of all master data information. The main benefit of the integrated approach is that it provides the most complete, accurate, and consistent single view of master data.

- **Hybrid MDM** – stores common data elements from participating systems creating a "light gold copy" of the master data, while disparate elements are referenced from their original system of record. The benefit and drawback of the hybrid solution is the partial combination of the federated and integrated benefits.

Service Oriented Architecture (SOA)

From a systems design perspective, SOA is an architectural approach based on distributed computing principles. SOA has numerous other aspects in topics as diverse as business process design and IT governance. However, these aspects go beyond our scope here.

As an architectural paradigm, the participating components of a SOA system include: service providers, service consumers, intermediary services, and registries. A service provider publishes a service in the registry to be consumed by a service consumer who can identify the interface, purpose, and location of the service from the registry. Intermediary services intercept and handle operations that are common across services and can be leveraged instead of recreated every time. Typical intermediary services include: authentication, auditing, logging, monitoring, and message routing. All communications are done through commonly agreed on standards (UDDI, SOAP, WSDL, XML, HTTP/SSL). The design principles governing SOA are primarily object-oriented paradigms extended to address the service-oriented requirements. These service design principles include: loose coupling, service contract, abstraction, composability, autonomy, reusability, statelessness, and discoverability.

Services access information from a data services layer. A data services layer provides an abstraction layer between producers and consumers of data. The data services layer presents consumers with a virtual aggregated view of data from multiple data sources in a consistent and centralized fashion. The layer's interface supports all consumers (human, application, external parties, or business services) while providing agility to data source providers.

A data service layer offers many benefits. Consumers are insulated from complexity, location, and changes in source data systems through abstraction. Providers have the flexibility to change underlying data schemas without impacting consumers through abstraction. Companies can centrally manage, monitor, measure, and report on the enterprise view of the data and metadata.

The three main categorizations of services in the data services layer are: Enterprise Data Services, Enterprise Metadata Services, and Enterprise Data Platform Services.

- The Enterprise Data Services area encompasses all the services around the data. For example, a request to be addressed by this area would be: Retrieve "gold copy" of "customer A" record.
- The Enterprise Metadata Services area includes all the services around the metadata. This area would address items such as: Retrieve master data schema of "customer A" record.
- The Enterprise Data Platform Services area supports all the services around the platform including management, monitoring, and reporting. An example of a request here would be: Retrieve MDM system, quality of service targets.

Services are defined in each area based on function (examples are shown in Figure 1). In each service and across all three areas, methods for search, access, create, update, delete, manage, monitor, and reporting functionality should be evaluated for applicability and realization.

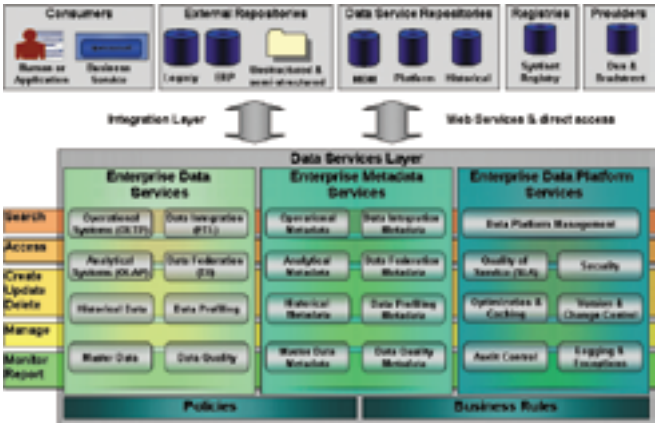

Figure 1: Data Services Layer

MDM Meets SOA

MDM and SOA evolved separately but share many design principles.

- **"Contract first"** applies to the interfaces in MDM and the service definition in SOA
- **"Reusability"** applies to data through conformance in MDM and services through SOA principles in SOA
- **"Discoverability"** applies to data through the master data repository in MDM and services through registry in SOA
- **"Abstraction"** applies to source system complexity and MDM and underlying service complexity under SOA.

MDM, however, typically doesn't embrace SOA's "loose coupling" principle. Extending MDM with loose coupling allows support for SOA's semantic conformance needs.

As MDM practitioners contemplating supporting today's SOA systems, we need to become familiar with SOA standards and strive for loose coupling with external systems. Eliminating point-to-point interfaces and replacing them with service-enabled integration minimizes the impact of changes from integration partners and consumers. Loose coupling should be applied internally as well to create an agile MDM system. An agile service-oriented MDM system provides its data quality, conformance, and other MDM functionality as business or data "services" available for net-enabled consumption by external parties. Finally, MDM systems should be able to handle the extensible data types (XML, HTML, PDF, and e-mail) common to net-centric application and be able to expose the master data model as part of the enterprise canonical data model (CDM) for service consumption.

Evaluate the maturity of your MDM system by answering the following questions:

1. Does my MDM support extensible data types such as XML?
2. Can internal, partner, or client services search, identify, and consume the CDM?
3. What is the effort for an application to participate in MDM as a consumer of the CDM?

4. What is the effort for an application to participate in MDM as a contributor to the CDM?
5. What is the effort to replace an external service provider?
6. Are data quality and conformance services exposed for use by applications or external parties?
7. What is the turnaround for changing the functionality of the current MDM system?
8. Can the MDM handle near real-time requests for conformance from participating systems?
9. Can the MDM exchange metadata with other MDM systems?
10. Can the MDM infer context and take action based on the semantics of the information being exchanged?

We've seen how SOA paradigms can contribute to the maturity of MDM. Now we'll focus on the other side of this marriage and see why SOA needs MDM. While SOA enables integration and data exchange through services, such integration is useless without a common vocabulary of data content and data structure. MDM defines how the enterprise establishes and maintains such vocabulary. To fully adopt enterprise SOA, an organization must first address MDM.

MDM is one of the most important components of the data services layer providing the required semantic integration of services for master data. Without an MDM system (or an ad hoc capability providing the MDM functionality), services don't know where to access the single version of the truth for "customer A" when there are multiple systems that capture "customer A" information. Moreover, this "customer A" information has to be the same in terms of structure, as well as content, when it's consumed by services.

The technical intersection of MDM and SOA occurs at the data services layer. For the data services layer to provide consistent information to consumers across the multiple data providers, data and metadata inconsistencies, discrepancies, omissions, and overlaps have to be addressed. This means that MDM functionality must be present. MDM crosses and has elements in all three areas of the data services layer mentioned above.

- Service enablement of traditional MDM functionality such as data quality and data harmonization (synchronization of data across participant systems and MDM) is exposed under the Enterprise Data Services area.
- The SOA designers and developers who are creating business services, as well as others consuming services, have to reference the organization's master data schemas. These master schemas are exposed in the Enterprise Metadata Services area, allowing consumers to draw inferences directly from their semantics.
- Finally, in the Enterprise Data Platform we find services around the management, measuring, monitoring, and reporting of the MDM system.

When the topic of semantically conformed data is raised, many firms point to their data warehousing initiatives. Consider the following typical question in that regard:

"I don't have MDM but I do have an existing Enterprise Data Warehouse (EDW) that covers the integration and data quality that seem to overlap what MDM is supposed to do. Can't I service-wrap my existing system to achieve SOA MDM benefits?"

Service-enabling the EDW is indeed a worthwhile and beneficial initiative but doesn't offer MDM capabilities. The reason is that most prior EDW efforts have concentrated on the integration and "business view" of data from disparate sources rather than the harmonization of the data at the source systems – meaning that when the source systems are service-enabled, they'll be in semantic conflict with the service-enabled EDW. In addition, EDW typically doesn't concentrate on master data, master metadata, and related data governance issues. Therefore, most EDW systems don't have the faculties for managing master data (such as an interface with workflow for business users to manage master data through its lifecycle). Finally, to successfully proceed towards an MDM solution, the initiative must be executively sponsored and business-owned versus an IT service enablement of an existing application project. To be clear, an existing EDW should, can, and will be leveraged in the new data services layer but doesn't replace the need for an MDM system.

Evaluate the maturity of your data services layer by answering the following questions:

1. Are my services impacted by changes to the repositories or databases being accessed?
2. Do my services have to call two or more repositories to read or update information?
3. Do two or more of the repositories being accessed contain overlapping information?
4. Do my analysts and developers need to understand the system internals and entity models for each interfacing system?
5. Do we have duplicate, incomplete, missing, or conflicting data across systems?
6. Can the data service layer provide a "single version of the truth" for the master data (customer, product, vendor, employee, and assets)?
7. Are my services semantically integrated to define the customer, product, or vendor?
8. Would data quality and conformance intermediary services be helpful?
9. Does my service taxonomy include services to access data and metadata across providers?
10. Is my enterprise data model exposed for consumption by the services?

The quest for the modern MDM system, and the single (data) version of the truth for SOA enablement, entails many challenges and risks. The highest business risks across both types of initiatives include: lack of executive support, insufficient business (versus IT) data ownership, and inappropriate skills or expertise. From a technical perspective, the highest risks include: inadequate performance, incorrect security of the exposed enterprise model, and ill-advised vendor selection.

Marrying MDM and SOA makes sense and offers vital benefits from both the MDM and the SOA perspective. Expect to see more such paired initiatives and vendors repositioning their products to cover the joint space better. ■

About the Author

John Kalogirou is MomentumSI's information management director. John has 15 years experience in managerial and technical roles guiding SMBs and Fortune 500 companies to implement information, integration, and intelligence solutions that improve business effectiveness and profitability.

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Enterprise Web2.0 Solves the Last Mile of SOA

Delivers a ubiquitous consumption of service

WRITTEN BY **BOB BUFFONE**

We are at an inflection point in the SOA roll out: with enterprises developing infrastructure and deploying services, the attention is now turning to how to deliver the services to the end user, increase service reuse, and deal with governance. The last mile of SOA needs to be bridged in order for IT to fully reap the benefits of their efforts by squeezing the last bit of ROI out of their infrastructure. To achieve this, IT needs to make SOA tangible to end users, while maintaining enterprise control and reliability.

Service Oriented Architectures: Meaningful to IT, Intangible to End-Users?

Service Oriented Architectures (SOAs) have become a de facto approach for engineering back-office IT systems. SOA provides IT with the benefit of being able to create, integrate and reuse application services quickly and cost-effectively so systems can be built and updated as fast as business requirements change. While SOA transforms application development and integration for IT, the benefits are often much less obvious to enterprise users. SOA applications look and feel like most other web applications and application delivery cycle improvements can be hard for the end-user to perceive.

Rich Internet Applications: Meaningful to End Users, Intangible to IT?

Rich Internet applications (RIAs) bring end users of Web and desktop applications what they have been asking for years: a zero install Web-based application that contains the richness of a desktop application. RIAs have furthered the capabilities of Web applications by adding desktop-like widgets to online applications. Improvements to the user interface of Web applications means end users can do more in less time. The AJAX wildfire has burned uncontrolled for the past two years and now it seems every Web application uses AJAX in some capacity. This has only increased the end user's demand for enterprise applications to take advantage of this technology.

AJAX to the end user is a magical elixir that can cure any application's ills. However, IT organizations must weigh the pressure of the end user's desire for better applications with the need to deliver enterprise-class applications. This is challenging. RIA products are typically simple widget toolkits with very little back-end integration and don't provide the enterprise-class reliability and robustness needed to build business-critical applications.

Enterprise Web 2.0: Meaningful to Both

Enterprise Web 2.0's (EW2.0) mission is to bring together RIA, SOA, and legacy systems to deliver business-critical applications over the Web. This combination of technologies provides benefits to both the end user through an RIA front end and IT with the ability to consume services and deliver them to the end user

in a business-critical capacity. EW2.0's capability to deliver business-critical applications isn't the result of a cobbled together framework, but a well-thought-out architecture that overcomes three core problems with leveraging the Web as a service platform:

- Complex and uncontrolled end-user environments
- Robust communications over HTTP
- Service consumption

No one ever said solving the last mile would be easy, but each of these problems has a solution. AJAX, if it taught us anything, it taught us that the desktop environment was richer than previously thought; you just need to know how to use what you have.

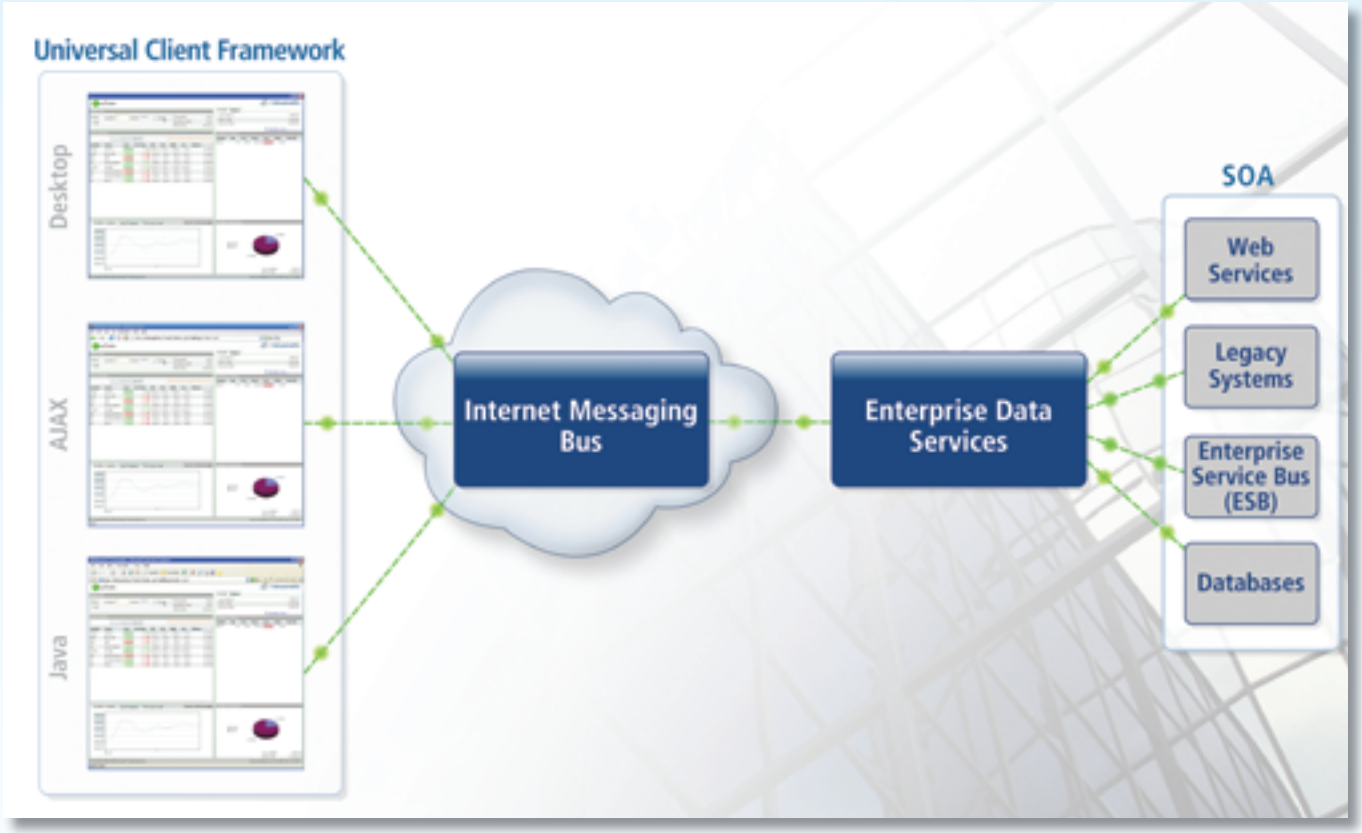
Controlling the Desktop Environment

Technology companies for some reason think that everyone has the latest and greatest software installed. Unfortunately, this is not true and for many IT shops trying to deliver SOA-based services to the end user, overcoming the desktop challenge is probably the biggest hurdle in delivering services. I sat on a panel a few months back, and everyone was talking about how great AJAX is, then one person raised his hand and brought the panel back to earth. He was working for a company building out an SOA infrastructure and trying to deliver applications to a chain of tire companies in the mid-West. What kind of computer do you think a tire company usually has installed? Firefox 2.0 running on Windows XP? No, in fact they were mostly using Win95 and IE4+. In order to overcome the problem of the desktop, the company had been tossing around the idea of shipping a new computer with every application. But even this solution has problems: Who will maintain a new system? Where will it be located in the shop? Does it need to be ruggedized? Then there is the plain expense of the computer eating away margins. A better solution is to take advantage of the software infrastructure already in place.

Solving the desktop hurdles requires a stubbornness that not many technology vendors have the wherewithal to maintain until it is accomplished. Most companies in the RIA space are just pitch-

— continued on next page

Nexaweb's Web 2.0 Solution



At Nexaweb, it has taken us four years to build out a Universal Client Framework (UCF) that can deploy applications in either AJAX or Java. It was nice validation of our UCF at the conference I attended when the person mentioned his problem deploying an application. The tire companies aren't the only ones with this problem. A nationwide chain of hotels came to Nexaweb about three years ago with a similar challenge. They had 4,000 hotel sites around the world, some of which were owned and operated locally. They had no control of the desktop and needed to deliver a reservation system to all 4,000 locales. They ended up using the UCF client framework to deploy a Java-based solution.

A Universal Client Framework not only needs to be able to be deployed in multiple environments, but also needs to encapsulate the problems of the multiple environments. Providing a layer of encapsulation between the issues of underlying technology and the application developer means the developer building the application can focus on what they should be focused on, their application.

Combining Enterprise Web 2.0's ability to deliver business-critical applications over the Web and SOA's ability to deliver services provides a solution that can deliver the ubiquitous consumption of service to anyone, anywhere in any environment

ing a solution that can be deployed in only one technology: AJAX, Flash, .NET, or Java. Each technology has its pluses and minuses. But to truly solve desktop obstacles, a solution needs to be able to deploy applications in multiple technologies. This allows IT to take a top-down design approach and choose the best technology to meet their applications, team skill-set, business, and environmental requirements.

Good Communication Is a Must for Any Relationship

HTTP was never intended to be a robust communication protocol, providing features such as pub/sub, server-side push, and reliable delivery. HTTP is a request/response architecture: a client asks for something and then may or may not get a response. Business-critical applications that need true client/server-like messaging capabilities have been left to be deployed as a fat client. Fat clients take a fat wallet to maintain. Once an application is installed, IT must deal with maintaining the application, rolling out changes when available.

Just like AJAX showed everyone that the browser was capable of doing a lot more, things like Comet and Nexaweb's Internet Messaging Bus (IMB) are doing the same for HTTP. Event-driven enterprise information and alerts for better decision making are sometimes a requirement for business-critical applications. A Japanese bank needs to deploy a real-time Foreign Exchange application to 10,000 geographically dispersed institutional traders. Designing latency into the application using polling techniques guarantees the data is stale by the time it gets to the end user. Using technology like Nexaweb's IMB means the bank can reliably send data to the end user in real-time as it comes in from their service bus.

Solving a complex network infrastructure is just as complicated as solving the desktop environment. Developers sometimes forget that when the application goes live, there will be many network devices between the end user's machine and the server delivering the messages. Each type of device, whether it is an SSL accelerated or a caching device, increases the chances for problems. Just like the way the UCF encapsulates the issues of the underlying client-side technology, the IMB does the same thing to the network tier, leaving the developer to worry only about the application's business logic.

Ubiquitous Consumption of Services

Giving IT the ability to consume services in an easy and repeatable manner is a must. SOA makes it easy to create new services and adapt an old service to meet changing business requirements; EW2.0 needs to be able to easily accommodate changes to the services. EW2.0 centrally managed application deployment mechanism and zero install means that when a change is deployed to the server, all end users will immediately be updated the next time the application is invoked. The use of the Universal Client Framework also makes it possible to change the definition of an application in one way, no matter what the deployment scenario is – Java, AJAX, online or offline.

Nexaweb's EW2.0 Platform allows IT to declare a service available to an application. Once declared, the application can invoke the service and bind the result to any number of components in the application. Through the use of a data-binding syntax, developers can cache the service results on the client and reuse them throughout the life cycle of the client, which minimize roundtrips to the server and increase the performance of the application.

Solving each of the three problems with using the Web as a service platform makes the delivery of services to the end user possible in an enterprise-class environment. The use of EW2.0 solutions is already under way in enterprises. Several deployments were referenced here, but many more are using solutions to deliver services to the end user.

Conclusion

Combining Enterprise Web 2.0's ability to deliver business-critical applications over the Web and SOA's ability to deliver services provides a solution that can deliver the ubiquitous consumption of service to anyone, anywhere in any environment. What to do with this ability will be the next challenge for IT and end users. IT will look for ways to create service-based components that can be reused across the enterprise. Instead of having just a sortable table they can reuse in applications, IT will look to create a service-enabled table they can drop into any application. The table will then be able to communicate with other service-enabled components to exchange data and events.

End users will look to be able to create their own mashup service components that will best suit their needs. An interesting tool by Yahoo! is doing just that. Yahoo Pipes is a new application that allows users to create data-driven mashups by using a slick interface.

Though not focused on the enterprise, a tool like that contains service-enabled components exposed by IT, allowing end users to create their own applications.

Enterprises will continue looking for return on investment of their service-oriented architectures. Enterprise Web 2.0 will make this a reality by connecting the last mile of SOA to the end users. This is a win-win-win solution for the enterprise, where not only IT and end users benefit, but business benefits as well, from increased ROI and enhanced use and IT productivity. ■

About the Author

Bob Buffone, chief architect, is responsible for platform and tool technology at Nexaweb Technologies Inc., a provider of the Nexaweb Platform enabling enterprise class, rich Internet applications (RIAs). Bob is also a committer on the Apache XAP Project, which provides an extensible framework for declaratively creating AJAX applications. Before Nexaweb Bob was with Trakus, a technology company focused on tracking sports in real time. A leading expert in User Interface design, he is a regular speaker at industry events and has published multiple articles on tool and application development.

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The Impact of Web Services on the IT Industry

How applications are defined, developed, and used to support the enterprise needs

WRITTEN BY **DAN HYNES, TUGDUAL GRALL, AND PYOUNGUK CHO**

Today's Internet-driven business environment is forcing companies to become more agile, enabling them to react quickly to changes in global markets and respond decisively to moves by competitors. At the same time, companies also need to use disparate internal and external systems as never before.

Web Services, which are increasingly manifest in the corporate world through Service Oriented Architecture (SOA) initiatives, address a number of the challenges and requirements facing the corporate world. These new paradigms are dramatically altering how applications are defined, developed, and used to support the needs of the enterprise.

In this article we examine the impact Web Services as a technology have had on enterprise IT. We'll specifically focus on the connectivity Web Services provide; the evolution of software development from silos of functionality to SOA; and some of the benefits reaped from adopting the Web Service paradigm.

Web Services Enable Connectivity

Much of the initial interest in Web Services originated with the promise of integration across disparate systems. Although integration is typically the term used to describe such efforts, what companies are really striving for is connectivity; that is, the ability to connect not just the hundreds or even thousands of internal legacy and homegrown solutions, but to connect with external systems beyond the firewall.

In fact, more than 60% of IT projects initiated today are focused on integration. These projects have traditionally fallen into two categories: enterprise application integration (EAI) projects, with a focus on using mainframe-based solutions in the enterprise; and business-to-business (B2B) integration, with the goal of connecting the enterprise with customers, partners, and suppliers.

Before the advent of Web Services, companies typically had to build or buy EAI and B2B solutions separately, because they were often based on proprietary technologies. This wasn't only costly; it also required extensive resources to implement and maintain these various systems. The need for such resources provided steady employment to legions of IT consultants.

Web Services changed the equation by defining a single set of standards for integration both inside and outside the enterprise. This means that Web Services can address the requirements of B2B and EAI in an almost uniform way, with the exception of policies and management aspects.

The result is that companies have been able to extend the lifespan of existing IT assets such as legacy systems and proprietary systems, as well as collaborate more tightly with external companies, all while leveraging the Web Services paradigm.

This is not to say that connectivity has been achieved painlessly; indeed, integration continues to present challenges. Despite the fact that Web Services have empowered companies to create new business opportunities out of existing IT assets and interoperate with external systems as never before, an inevitable cost — complexity — can be incurred when things go too far. In particular, creating too many interdependencies across different lines of business can hurt the goal of business agility.

Web Services Redefine How Enterprises Approach Application Development

The days of the monolithic application development project may very well be over, deferring to the lighter, more-agile Web Services paradigm. This represents a fundamental shift in the way enterprises plan, develop, and integrate new applications.

Companies have come to view the reuse of existing assets as central to their development process. Instead of building new applications, companies are now investing time and resources in

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-Steve T, System Architect, B2B Application Development Pfizer, Inc.

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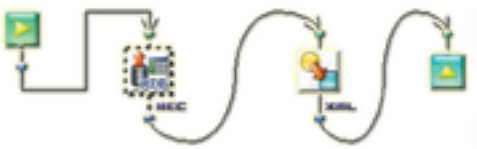

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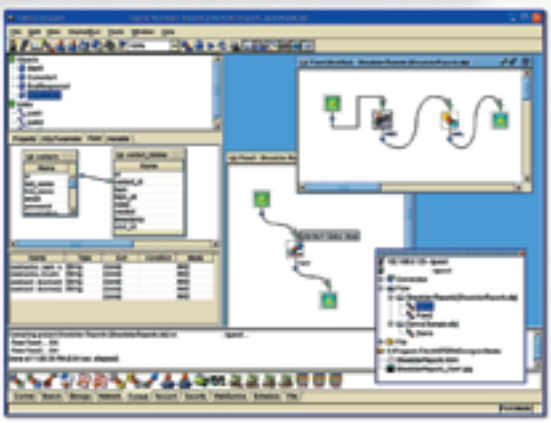

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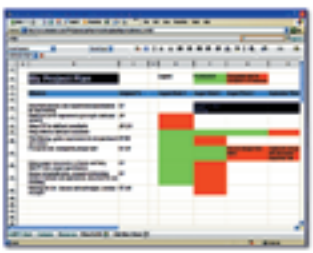

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expanding portfolios of Web Services, looking both internally and externally to discover services that can fulfill specific needs.

Indeed, companies are now realizing that it's often more practical to buy or borrow functionality than to build it. Rather than implementing and maintaining the vertical applications themselves, companies can now leverage existing functionality provided by the vendors of those products.

A classic example is Google's publicly available Web API services, which enable developers to enhance any application with the ability to search billions of Web pages. A new niche market of sites such as StrikeIron, which is a sort of an eBay for Web Services, is slowly evolving, enabling companies to discover and buy access to services to leverage in their own applications.

The business implications of providing access to vertical applications exposed as services are even more promising. Most vendors of enterprise-level software such as customer relationship management (CRM) and enterprise resource planning (ERP) systems already expose their offerings via Web Service interfaces.

Vendors such as Oracle are offering customers even more options by exposing entire packaged application suites that provide vertical business functionality as Web Services. With such suites, enterprise customers can build out mission-critical applications and processes that are actually composed of a number of best-of-breed solutions.

The availability of such third-party services has reduced the overall effort required to bring a new solution online, not least because it reduces the demands on those involved. A company analyst tasked with specifying an order management system no longer needs to figure out how to integrate the new application with a commercial ERP product; he can simply search the enterprise portfolio for the ERP service that meets his needs. And the developer who implements the solution can simply integrate the appropriate service into the project without regard to how the back-end application is implemented.

Web Services have also helped reduce the gap that has traditionally existed between the IT and business sides of the enterprise. Traditionally, the business side provides IT with a set of requirements that IT then attempts to interpret. But because each side approaches the issue with a different perspective, problems simply understanding the issues, let alone addressing them, are inevitable.

With Web Services, both sides are now speaking the same language — the language of business — with more productivity and fewer cycles as the result. The human-friendliness of Web Services is key to its success; non-technical business stakeholders are more likely to be able to make sense of service interfaces. Instead of getting bogged down in details, IT can now take basic requirements and represent them as interfaces that senior management and business analysts can understand.

Of course, lack of communication was only part of the problem in traditional development practices. Once requirements were more or less communicated, the complexity involved in implementing them posed yet another challenge. For example, a typical request for minor functionality from the sales organization entailed having to map each requirement to numerous remote procedure calls. Web Services allow requirements to be abstracted as services, enabling far fewer mappings and reduced complexity on the business-facing front-end.

That is not to say that the challenge for IT has completely disappeared; the back-end business components can be just as complex as ever. However, the interface into the business logic implementation is far easier to understand, resulting in fewer misinterpreted requirements. And unlike the past, the enterprise can now look to external solutions that map to its requirements, rather than focusing exclusively on in-house development.

Therefore, it's clear that Web Services have made the concept of the adaptive agile enterprise a reality. Because services are granular to a specific part of the system, systems can evolve with the business.

With Web Services, a late-breaking business requirement does not require a complete refactoring and redeployment of the user-facing application; changes to Web Services typically require that only a small part of the implementation be modified. Such changes can usually be done in isolation, independent of the rest of the system, resulting in reduced downtime. And new services can be readily plugged into existing business processes.

The emerging use of business process flows implemented as business process execution language (BPEL) processes is evidence of how companies are recognizing the agility that Web Services and SOA bring. In BPEL, end-to-end processes are composed of various Web Services that are called into action according to defined events and rules. New and updated services can be plugged into a process without any interruption to users or the business.

Business Benefits that Drive Web Services & SOA Adoption

At the end of the day, any technology a company adopts must support its basic business needs, such as saving money and improving its ability to sell and deliver its product. Web Services and SOA are no exception.

With the connectivity Web Services provide, information can be accessed and used across the enterprise in a consistent manner. Because services are decoupled from the underlying implementation, users can interact with myriad systems through a single unified interface, rather than having to understand each of the various application silos.

Software vendors and enterprise IT groups alike look to Web Services as key to linking people, processes, and information together. Users are no longer even aware of the full suite of applications they're actually using as they weave their way through a business task. Empowering users this way results in better productivity and greater innovation.

In the same vein, the ability to connect internal applications with partners, suppliers, and even customers is another critical area of focus in enterprise IT. Business-to-business arrangements in particular have benefited from this connectivity: A supplier can now check stock levels by connecting directly with a customer's inventory management system, anticipating new orders before the customer is aware of the need.

Perhaps one of the most important yet often overlooked benefits of Web Services is their impact on the company's bottom line. CTOs faced with shrinking budgets and greater demands increasingly rely on solutions based on Web Services.

As noted earlier, Web Services and SOA let companies reuse existing investments by exposing existing applications and systems as services. Increasingly, IT management in such companies often attribute reduced development costs and increases in productivity to the adoption of the SOA model.

The external services available from industry-leading vendors

—continued on page 30

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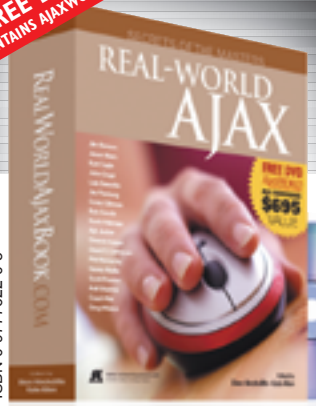

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The New Language of Business: SOA & Web 2.0

The Top 10 Don'ts!

WRITTEN BY **SANDY CARTER**

Understanding what not to do is just as important as understanding what to do. Understand the value of SOA. SOA is about flexible business processes. It's not just doing the same thing you've done before in a different way. Although you should absolutely approach SOA incrementally, the benefits you can achieve are dramatic. And unlike other IT approaches, SOA is not just about technology. SOA is really a mindset and a way of approaching business problems. It supports the flex-pon-sive* company by merging technology, business insight, and thought leadership to create an environment in which innovation can thrive.

How does your company get started? There's no single answer; it depends on your business priorities. Here you see that a focus on a real business problem, not SOA, is a critical part of success. If possible, start with revenue-generating applications in small bite-size hunks. Make sure that you focus on skills by building capabilities. And make sure you have that long-term plan in place that gets your business to the flex-pon-sive* state.

Taking an approach to SOA that is business-centric ensures that you are keeping your investments focused on areas that will mean the most for your bottom line. Whatever your approach, be sure to think through reuse and best practices. Take a portfolio-management perspective and decide what kind of assets you need to run your business. Then figure out where these assets come from. Newly created and reused services are the building blocks of SOA. Reuse gives users flexibility through reduced cycle time and elimination of duplicate processes.

For your first project, have a solid plan with governance at the heart. Governance is critical for success. Use the first project to establish credibility and to validate financial assumptions, to seed your CoE, and to establish architectural guidelines and organizational infrastructure to ensure reuse.

The Top 10 Don'ts!

A flex-pon-sive* company is one that responds with lightning speed and agility to rapidly changing business needs. I always learn from my mistakes — what to do different and what to do better. As such, I wanted to make sure that I included not only what your company should focus on, but what you should avoid with the top 10 don'ts. I got this idea watching David Letterman while poring over scores of customers that have already started to focus on flexibility. I want to cover the lessons that others have learned in hopes of sharing that knowledge.

The top 10 don'ts for your flex-pon-sive* journey are:

1. Don't expect maximum business without SOA.
2. Don't just do technology; it's a transformation of the way you do business.
3. Don't throw everything out.
4. Don't bite off big projects all at once.
5. Don't forget to set expectations.
6. Don't expect to do this without a culture modification through governance.
7. Don't forget the right skills.
8. Don't expect flexibility without open standards.
9. Don't do this alone — leverage partners with experience.
10. Don't do it without a strong plan because the first step is the most important.

Each of these "don'ts" is based on a wealth of SOA engagement experience and a true focus on business models and innovation for flexibility. I share that learning so that you can leverage the experience and leap ahead in your quest for competitiveness.

Don't Expect Maximum Business without SOA

They say that French is the language of love, and I say that SOA is the language of business flexibility. SOA is an approach that draws IT and business together and drives a discipline toward flexibility. Of course, we've heard this before, but it's truly different. One of IBM's top architects, Rob High, and one of IBM's top SOA consultants, Jason Weisser, summed it up this way:

"SOA is the link to the business. It is an approach to architecture that enables the flexibility required for innovation across the board. Why? We discussed in detail the role both XML and Web Services play in SOA. They are the glue like HTTP is the glue for the Internet. Web Services allow companies to have the necessary IT support so the business can be viewed as a set of services."

From a brief technology perspective, the technologies key to SOA, XML, and Web Services had better accommodate change. Said ever more strongly, SOA-based technologies enable you to build for change! For example, it's possible to add or reorder elements in an XML business object without breaking code. The same applies to WSDL, another standard prominent in SOA. From a technology viewpoint, older approaches, such as RPC or CORBA, don't allow this flexibility.

Additionally, Web Services offer the flexibility of having learned from the mistakes of previous methods (such as CORBA and RPC). The designers of Web Services learned that it needed the flexibility to support both asynchronous messaging and remote procedure calls. Before, support for one was there and the other was added later. Just as with a house, building additions is never as efficient or as flexible as designing it in the beginning.

In addition to this flexibility enablement, another enabler is language independence. XML renders more naturally into multiple languages, such as C, Java, COBOL, and so on.

Because SOA is based on these two critical elements, Web Services and XML, it's built for flexibility. It enables businesses to be on-demand and be able to respond to whatever the market throws at them.

Flexibility and cost savings continue to be crucial goals. Key to attaining these goals is an SOA strategy because it helps companies save money as they implement on-demand flexibility.

Don't Just Do Technology — It's a Transformation of the Way You Do Business

Okay, so I just told you not to look at SOA as a technology. IT is an approach. SOA requires business processes that are represented as services. However, the most successful companies don't consider this to be an IT-led journey. In fact, they view it as a partnership between business and IT.

For example, consider St. George Bank, Australia's fifth-largest bank. It's one of the top 15 public companies in Australia, employing more than 7,500 people. Its national operations span all aspects of the finance industry, including retail banking, institutional and business banking, and wealth management.

Customer satisfaction is of utmost importance to the bank and it can't afford to have IT challenges distracting it from its customers and business, which is why reusable services make so much sense. The cost of new product development and time-to-market are greatly reduced, enabling the bank to be flexible to business drivers while minimizing the cost to make the necessary changes.

At St. George Bank, the enterprise architecture team is co-located with the business. Greg Booker, head of group architecture, explains:

"I have two architects working on the same floor as the business leaders in commercial, and I have two architects working with the retail folks, so they're not locked away in an IT center, completely disconnected from the business. They are people that understand the business pressures or business issues from a day-to-day perspective, and the business is also able to reach out and touch those guys and talk to them.

"We're able to communicate to the business in terminology they appreciate like "fee to market," "reduced complexity," and "reduced costs," all of which it wants to hear about. It doesn't want to hear about the fact that it's a bunch of reusable components that are linked together with Web Services and all the rest of it.

"This level of engagement is critical," concludes Booker.

St. George Bank is well along the path to achieving a flexible business model and what makes a difference to the bank is the true partnership between the business and IT. This is not about the technology, but about the way you do business.

One of my most demanded presentations to CIOs and their teams isn't about SOA, but it is a mini-MBA course. The best-run companies have IT teams that understand the business. Get your business requirements in clear view, and then make sure you have a mechanism to ensure that those are taken from the business down to the technology. The advice around governance is one of the secrets of success that all customers called out.

A way that we look at technology reuse at IBM is that the breakeven point for reusing a service is 1.6. That means that the first time you reused a service (meaning, used it a second time) you're saving money

Don't Throw Everything Out!

You can go after success in many different ways. But one thing that I've observed is the success of those who don't rip out years of knowledge, best practices, applications, and technology. The common thread is that all of them inventoried what they had and ensured that they selected an approach that let them leverage current resources. For most of the companies that I've worked with, the whole premise going in has been that the cost savings from initial efforts will provide the fuel for future strategic investments.

Reuse has been talked about for a long time, but previously technologies have never really been successful in bringing about large-scale reuse. And reuse has only focused on technology, not elements of business process and knowledge. SOA addresses this head on, with a focus on breaking down the roadblocks that have hindered reuse efforts in the past.

Reuse involves two areas:

- Technology reuse
- Business process or model reuse

Both are powerful concepts. Let's look first at the concept of technology reuse, which is the most prevalent way that companies today are realizing SOA's value proposition around cost cutting. A service repository is used during development as a catalog of services. It's where integration developers can go to see the services they have available to reuse. A service registry is used during runtime to hold all the "metadata" about a service — information such as the service description, usage, and versioning, for example.

The way that we look at technology reuse at IBM is that the breakeven point for reusing a service is 1.6. That means that the first time you reused a service (meaning, used it a second time) you're saving money. Reuse of services reduces costs by helping to eliminate duplicate development and maintenance.

The other area of reuse is on the business side. This involves reusing business logic. For example, suppose a company has a variety of customer services running on a federated model where each business unit operates autonomously and is supported by its own IT organization and infrastructure. The result would be that the same business process and supporting applications are implemented in many ways. The challenge of building a unified view of the customer across all the business units brings home the impact of reuse of business logic. Many companies will select the best practice for customer information and standardize that best practice into a single federated view — thus reusing the best practice process. This is one reason why the SOA approach is used when companies have done a lot of mergers or acquisitions. A lot of times mergers and acquisitions bring into play a lot of duplicate processes, thus reuse of the best practice or business model.

Reusing services helps companies standardize business processes. So reuse saves money and helps companies run in a more consistent and efficient manner by helping to eliminate overlapping and potentially conflicting services within the organization.

Don't Bite Off Too-Big Projects

Thinking incrementally about how to get there is critical. It's not just about the dollars that tended to be reinvested but more about proving and showing the value of success to the organization.

Have you ever heard about Zeno's Paradox? Zeno of Elea (circa 450 B.C.) is credited with one of the best-known paradoxes about the tortoise and Achilles. (Achilles was the great Greek hero of Homer's Illiad.) It is an interesting paradox and has been around for a long time. The story begins with Achilles and a turtle discussing a race. The turtle challenges Achilles and asks for a head start. In the end, they don't race because the turtle convinces Achilles that because he has a head start, and because Achilles must continually make up that distance, the turtle would always win. His argument was that Achilles would have to cover half the distance then half the remaining distance then half the remaining distance then half the remaining distance...and so on forever. The consequence is that Achilles would never win.

Rather than tackle Zeno head-on, let's pause to notice something remarkable. Suppose we take Zeno's Paradox at face value for the moment and agree with him that before I can walk a mile, I must first walk a half-mile. With the number of small distances, adding all those distances should just give me back the finite distance I started with. And poor old Achilles would have won his race.

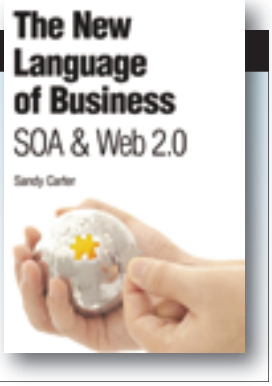
The trick here is to understand where you need to go and then begin with small projects that help you get there. There are several key starting projects. These entry points help businesses pursue flexibility through SOA the right way: by taking a project-based approach and demanding that each project deliver real business value. A recent study of more than 500 companies, conducted by Mercer Management Consultants, showed that the successful companies surveyed are approaching SOA from entry points of integrating people, processes, information, or a combination of all three. So learn from your initial SOA projects by making sure they are small, well defined, and quick to implement. ■

About the Author

Sandra Carter is Vice President, SOA and WebSphere Strategy, Channels and Marketing. Sandy's track record speaks for itself: IBM's SOA initiatives consistently earn third party validation and top leadership rankings by analysts and pundits alike; 4Q2006 marked the fourth consecutive quarter of double-digit growth, and the WebSphere brand has won seven industry awards.

About the Book

This content is excerpted from Chapter 9 of the new book titled, *"The New Language of Business: SOA & Web 2.0"*, authored by Sandy Carter. The book is published by IBM Press, February, 2007. ©Copyright 2007 by International Business Machines Corporation. All rights reserved. ISBN 013195654X. For further information, please visit www.ibmpressbooks.com



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>
> — Yafim Natis, Gartner Analyst

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WRITTEN BY **LUBA CHERBAKOV**

Like many other enterprises, IBM is transforming itself in response to fierce global competition and partnering, real security threats, the plethora of regulatory requirements, and demands for more flexibility and agility. Service-oriented thinking and Service Oriented Architecture (SOA) play an important role in this transformation.

In this article I describe four IBM SOA-enabled transformation initiatives, driven by different business value propositions – from regulatory compliance, to a more flexible business model, to cost reduction by eliminating duplicate systems and processes. For each case study, I describe business situation and challenges, changes that were implemented to effect the transformation, SOA-enabled solution, and tangible business results. I also describe the best SOA-practices used, technologies that enabled each solution and lessons learned.

Much has been written about the current business environment and the undergoing dramatic changes: fierce competition from traditional and non-traditional players, ever changing regulatory compliance requirements, pressure to create new revenue sources, and demands for more innovation and flexibility. To succeed in this environment, enterprises are transforming by rethinking industry structures, becoming componentized, and adopting service orientation to achieve desired flexibility.

SOA finds increasingly broad acceptance and is emerging as the dominant technology to support such business transformation by providing tighter links between business processes and enabling IT. While analysts call IBM "one of the foremost pioneers in the movement toward Service-Oriented Architecture" for work with its clients, most people don't know that IBM's SOA test bed has been IBM itself. To date, IBM has deployed more than 90 services that have sped our transformation into an on-demand business. As a result, clients often ask us to share our experience with them. In this article I'll describe four IBM initiatives that represent a wide range of business challenges solved by SOA-enabled solutions.

The case studies include:

1. Customer Order Analysis and Tracking System [COATS]
2. Microelectronics "factory in a box" [Microelectronics]
3. IBM Intranet Password External [IIPX] – identity management for business partner applications
4. Export Validation [Export]

Some of these case studies represent common problems facing many industries, (e.g., case IIP), while others are industry-specific problems, with typical challenges that can be successfully addressed by SOA (e.g., microelectronics).

Readers, who ask why they should consider SOA or want to create a business case for its adoption, may find the Table 1 Business value

propositions for SOA adoption below and the detailed descriptions of business drivers for each initiative helpful.

In addition to business context, each case study describes the challenges that the initiative had to overcome, an architectural overview of the SOA solution, and details on the resulting business benefits. I'll also describe best practices, and "lessons learned" that IBM is replicating now across the company and with its clients.

SOA Value Propositions

During the last few years, my colleagues and I have worked with hundreds of clients to implement SOA-based solutions to various business problems. While everyone is talking about business flexibility and agility, initiatives are usually driven by a concrete business value proposition. Desired outcomes can fall into several categories described in Table 1.

Business value proposition	Business drivers
Ease of systems integration	• integrate historically separate systems • facilitate mergers and acquisitions
Cost reduction	• eliminate duplicate systems, skills, and investments • build functionality once and reuse • improve efficiency
Business process flexibility	• react to market changes faster • improve time-to-market
External processes cost and cycle time reduction	• move from manual to automated transactions • facilitate collaboration with business partners
Risk and exposure reduction	• improve visibility into business operations
Regulatory compliance	• meet government mandates • meet industry regulations

Table 1: Business value propositions for SOA adoption

While a successful SOA implementation can achieve several different business outcomes, there are often one or two key drivers that spark an initiative. It's worth mentioning that while benefits achieved through services reuse leading to reduced development and integration costs are essential in the long run they're secondary to SOA's business transformation value.

The IBM case studies described below had different desired outcomes and business drivers, both internal to the corporation and external, as depicted in Table 2.

	COATS	Microelectronics	IIPX	Export
Business process/model flexibility	x	x		
External processes cost and cycle time reduction		x	x	x
Risk and exposure reduction			x	x
Regulatory compliance				x
Ease of systems integration	x	x	x	x
Cost reduction	x	x	x	x

Table 2: Business outcome summary for cases studies

Case Study 1: Customer Order Analysis and Tracking System - From Legacy to On-Demand

Business Context

Customer Order Analysis and Tracking System is a shared order entry application for more than 20 IBM manufacturing plants worldwide, each with its own customization needs and access patterns, e.g., High Volume-Low Price versus High Price-Low Volume. With 365 x 24 coverage, COATS fields orders from IBM customers, business partners, and IBM sales professionals for "complex" configured hardware.

Buyers indirectly access COATS to order new machines, upgrades, and customizations, and change existing orders. The application sorts and prioritizes these orders, comparing them against manufacturing rules and the customer's installed hardware base. COATS "translates" customer orders into a bill-of-materials and other instructions, which are then forwarded to the appropriate manufacturing plants. The manufacturing plants fulfill the orders and ship them to customers.

Challenges

The original application, a complex 25-year-old batch system, included 1.4 million lines of code in PL/1, OS/390 Assembler, Java, and other programming languages and was running close to capacity at peak times. Batch bottlenecks and conflicting data delayed orders and shipments.

With its hard-coded business rules, COATS couldn't be adapted easily to address the needs of IBM's business. To handle altered orders, including automatic alterations done by the scheduler system to meet customers' delivery dates, multiple databases had to be updated and queried, depending on geography and other parameters.

To support new product introductions, business opportunities, and outsourcing requirements, IBM frequently updated the application, spending considerable time and money on new functionality development – each version took six months to develop and more than 8,000 developer hours.

By early 2000 we knew we had to improve access to functionality and the valuable business data residing in the legacy system. We also had to be able to access it easily from other systems. Nevertheless, as with many enterprise-critical applications, "big bang" replacement was unaffordable and disruptive.

SOA-based Solution

The ongoing Order Management Component Services project is transforming the overall COATS into a real-time order submission system.

Figure 1 depicts the solution architecture that standardizes the connections between our business processes and IT requirements. In this architecture, the business rules are externalized and legacy system functionality is componentized to promote flexibility, scalability, and reuse.

The development team started with business process modeling using IBM's WebSphere Business Integration (WBI) Modeler. The workflows were enhanced using the WebSphere Application Developer – Integration Edition (WSAD-IE) tool with business objects from Rational XDE and integration of legacy adaptors. We connected legacy systems with business processes through IBM's CICS and MQ technologies.

Business Results

Several incremental releases of our new SOA-based solution resulted in improved business performance and flexibility, as well

as reduced development costs and faster development turnaround time. The business benefits included:

- Order transaction processing time fell from four minutes to 10 seconds. When you consider that COATS handles an average of 2,500 transactions a day, this represents a potential daily time savings of more than 150 hours.
- Improved systems integration enabled real-time transactions, reducing discrepancies in delivery scheduling
- The new system eliminates redundancies, allowing IBM to react with more agility to changing order fulfillment requirements. We can now make changes to the runtime workflow on-demand through easily selectable rules.
- We reduced development costs per release by more than 25%.

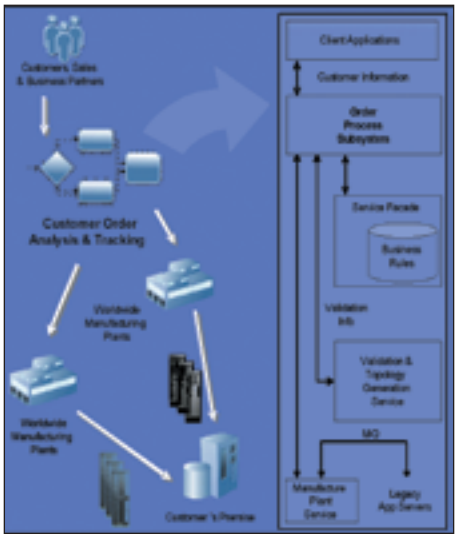

Figure 1: COATS architecture overview

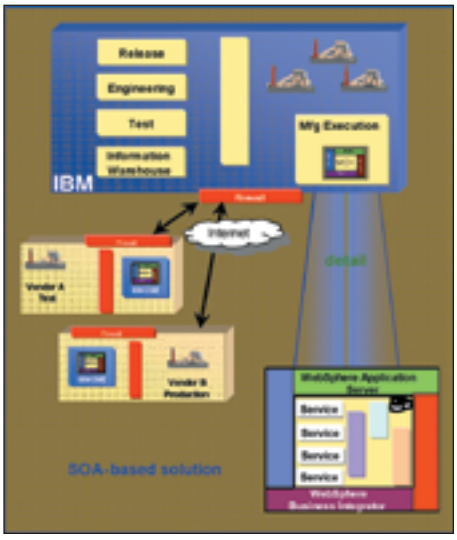

Figure 2: Virtual manufacturing architecture overview

Best Practices Used and Lessons Learned

This initiative helped us create methods for the incremental transformation of legacy business functions into agile SOA-enabled solutions. Best practices used and lessons learned included:

1. ***Implement services incrementally*** to provide early buy-in and a non-disruptive migration path while managing expectations. Co-existence of services with legacy code supports the gradual transition of system functions to the new architecture.
2. ***Align business/IT architectures*** through service modeling
3. To develop agile business processes, ***address the full services lifecycle*** – from modeling to monitoring – supported by methods and tools
4. Follow an ***iterative*** design and ***incremental*** development employing modeling, design, and integration ***patterns***
5. Create early BPEL process models that don't include activities details (they should be documented in the use cases). Create a data model at the same time you create the business process model
6. This initiative helped us ***harden the IBM Service-Oriented Modeling and Architecture (SOMA) method.***

We demonstrated incremental transformation through proper use of service modeling, incremental development methods, tools, and middleware components. The process customization, incremental transformation, and legacy integration methods developed on this initiative are being replicated across IBM and with our clients.

To learn more about how to build reusable assets to transform an order processing system, see the IBM developerWorks series On demand business process life cycle.

Case Study 2: Microelectronics "Factory in a Box"

Business Context

Like most companies, IBM is no longer operating under the assumption that it will do all business functions in-house. We rely on an ecosystem of companies that help us focus on our core business competencies by assuming responsibility for some of our non-core tasks.

Our microelectronics business, for example, is moving from vertical integration to a global participant network. In 2003 IBM Microelectronics recognized the need for more flexibility in reacting to the changing manufacturing requirements associated with wafer and module manufacturing across multiple sites and vendors.

Challenges

IBM Microelectronics experienced challenges similar to the rest of the industry players:

- Technology **cost and complexity continue to rise** as does the demand for custom solutions (as opposed to standard products), while product unit costs fall.
- Demand volatility drives **expense and investment volatility.**
- Pressures to fuse advanced technology with business design to create an integrated, **more flexible and responsive** manufacturing environment
- To achieve flexibility with multiple manufacturing sites need to eliminate **duplicate systems, build once and leverage,** and **improve time-to-market**
- Requirements for consolidation of financial management by integrating **historically separate systems**

SOA-based Solution

To address these challenges, IBM developed a solution based on modularized architecture that provides efficient outsourcing by installing a factory-in-a-box on partner premises (depicted in Figure 2). One of the primary enablers of this virtual manufacturing is the Multi-Source Data Integrator (MDI), an IBM server containing a standardized suite of services that will exist at any manufacturing location to be integrated into the virtual manufacturing environment. The architectural solution uses industry standards and integrates the business partner's manufacturing processes with those of IBM, enabling the seamless outsourcing of bond, assembly, and test.

MDI is built on a foundation of proven IBM middleware: DB2, WebSphere Application Server, MQSeries, WBI, WBI Connect, TCI (includes wafer map management, data transport/translation, and tester support), and TCIServices (includes composite rules, autosetup, and disposition).

B2B messages trigger actions and logic with the MDI in real-time. MDI internal message formats are patterned after Roset-

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taNet standards. After WBI-C receives and delivers messages to MDI processes at the receiving location, they are the same Extensible Markup Language (XML) format as messages sent directly by the sending location.

Business Results

This solution created "virtual" manufacturing for microelectronics – a "factory in a box" enabled via SOA:

- Multiple, **interchangeable, integrated** partners
- Routine upgrades to deployed software are seamless (i.e., no downtime, no negative impact to production).

As an example of a business situation, an IBM Singapore facility was sold to Amkor Technologies. The facility was disconnected by IBM and reconnected by Amkor in just four hours – this was a process that could have taken as long as three days before the implementation of the new SOA-enabled architecture. IBM rules were updated, IBM manufacturing went down, and Amkor manufacturing came up.

Best Practices Used and Lessons Learned

Virtualization and **isolation of business domains with related processes and data** created "isolation framework" between domains that enabled "Virtual Factories."

Reuse of a **SOA reference architecture** and best practices, harvested from earlier SOA enterprise initiative (COATS redesign), significantly reduced the project time.

Case Study 3: IBM Intranet Password External

Business Context

As IBM internal Web applications proliferated – many of them business-critical – they all created their own authentication processes and functionality. It became clear that IBM needed a global authentication facility for Web applications – one ID/password for each employee. The IBM Intranet Password (IIP) was then developed and deployed as a common solution to enable identity management for internal applications. Unfortunately, IIP's objective of a single ID/password for each IBM employee wasn't fully realized – besides internal applications, there are numerous IBM Business Partner sites and applications that IBM employees use including outsourced HR functions (such as benefits and pension), 401K, travel booking, and others. These business partners created their own unique ID/password schemes for each of the systems.

Challenges

Rapid proliferation of IDs and passwords created huge problems for employees and application providers. For employees, this meant more time spent keeping track of numerous IDs and passwords, as well as time spent managing expiration and different rules for what constituted a valid password for each partner application.

With their unique authentication systems, IBM partners providing business solutions had to ensure adequate help center coverage for calls by IBM employees requiring credential assistance. In addition, the overhead costs related to the development and management of authentication management solutions and business rules also had to be recovered in contracted charges to IBM.

The need for individualized authentication across multiple partner applications to improve employee satisfaction and reduce costs became obvious. Several different solutions were considered to address this problem. Initially some business partners requested a copy of IBM's employee LDAP directory, along with periodic updates, to manage the authentication of IBM employee credentials themselves. To maintain the integrity of IBM's internal network at all times, IBM couldn't share its LDAP data outside the company or provide partners access to IBM's internal network to use internal LDAP instances directly.

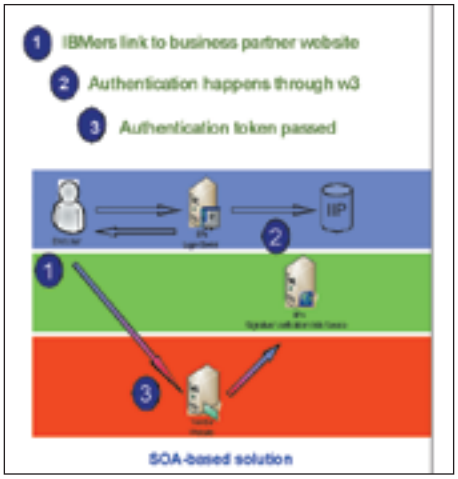

Figure 3: IIPX architecture overview

SOA-based Solution

The resulting SOA-enabled solution, named IIPX, is depicted in Figure 3. IIPX is based on the foundation laid by the earlier deployed IIP solution that provides employee identity management for internal applications.

Externally hosted applications verify the identify of IBM employees by using an IBM Web Service that validates a digitally signed XML document indicating that an IBM employee has already been authenticated by IIP. IIPX creates the token after employees are authenticated by IBM's internal IIP, which performs native LDAP authentication using IBM's internal directory. After users are authenticated internally, their browsers are redirected to the external site.

Business results

This simple solution was quickly accepted and got positive feedback from partners and employees alike. The introduction of this new authentication functionality improved employee productivity and IT satisfaction yet was virtually transparent to employees. Through the implementation of this service, IBM achieved the business flexibility that allows new employee users to be added and IDs and passwords to be managed from within IBM's already established mechanisms. IBM business partners have achieved measurable cost-avoidance by consuming this service, because they don't have to manage IDs/passwords for all users.

Best Practices/Lessons Learned

Reusing the existing and proven IIP SOA solution in a new environment demonstrated the flexibility of SOA.

Although IBM partners quickly accepted this solution, it took time to convert their individual solutions, based on their own schedules, availability of resources, and other business constraints. Incremental rollout allowed them to define individual and non-disruptive conversion paths.

Case Study 4: Export Validation - Regulatory Compliance

Business Context

IBM must comply with U.S. export regulations for product deliveries within the U.S. and abroad. This requirement is met

by multiple applications performing export checks on customer demographic data and product purchases and delivery.

Each month the U.S. Export Regulations Office publishes a new version of its Denied Parties List. When a new list is distributed we have to check existing customer data against the new list to ensure none of the additions match existing customers.

Challenges

Multiple applications support U.S. export regulations compliance. Existing brittle legacy architecture made modifications and extensions cumbersome. Each time an application needed export checks integration work was required to incorporate the existing common export code. It was custom work each time and very specific to the application. The IBM Software Delivery and Fulfillment organization, responsible for implementing the U.S. Export Regulations Procedures, wanted a solution that would be easy to integrate and was highly reusable without rework.

SOA-based Solution

The Export Validation Service (EVS) was first deployed in December of 2003. Implemented as a Web Service, it's easily used by multiple business applications requiring export validation functionality.

The solution, depicted in Figure 4, includes externalized business rules that allow for real-time updates of U.S. government-driven compliance lists. The EVS fits perfectly with what service-orientation is intended for – use by multiple applications on different platforms since no specific integration is required.

EVS does export checks with the provisions for override capability. Requests and responses are sent in XML format using SOAP over HTTPS. Once a consumer application has set up an interface to access the EVC no additional changes are required.

Updates to the Denied Parties List or other export regulation checks are contained in the service. The consuming application sends customer demographic data via the defined interface implemented as XML documents. Export checks are run using this data and the results are returned via the defined interface. When there is an export failure the customer's data is added to an override administrator's queue for review via the Override Administration service.

Business Results

Through this solution IBM was able to improve **responsiveness** to frequently changing U.S. government export regulations. For new applications requiring export validation functionality, dramatic **development cost and cycle time reductions** were realized. In addition, measurable **cost savings were achieved in ongoing support** of compliance with changes in U.S. government Denial Parties List and other business rules.

Best Practices/Lessons Learned

During the implementation of this solution, we once again saw the importance of externalizing business rules. Besides providing more flexibility, externalized business rules allowed **delegation of decision-making authority, accountability** on rules interpretation, and support of a single team of experts. Identifying what decisions have to be made and who needs to make them is an important step in overall SOA governance.

The team has also used incremental onboarding of legacy applications that provided a non-disruptive transition path.

Conclusion

The parallel evolutions of businesses and IT raised the new challenge of establishing a tighter link between business strategy and enabling technologies. SOA finds increasingly broad acceptance and is emerging as the dominant technology to support business transformation as a significant step in bridging this business-IT gap.

The four SOA initiatives described in this article have helped IBM reach new levels of business efficiency through the faster introduction of new business capabilities and optimized business processes. As these case studies demonstrate, SOA enables historically isolated data and functionality to interoperate throughout enterprises and greatly improves collaboration with customers and business partners. It uses existing resources to improve productivity and the enterprise's ability to react quickly to changing business needs, regulatory demands and market conditions. SOA-enabled solutions help achieve desired business flexibility by providing increased visibility into business operations and making changing to processes and business rules faster, broader, and less expensive, even across organizational boundaries.

SOA could be one of the most significant technological advances helping enterprise achieve business agility required in 21st century. ■

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Cementing Customer Relationships through SOA and Integration-as-a-Service

An emerging on-demand integration solution

WRITTEN BY **ANDREW DENT**

Customers want smooth fast purchase transactions. They want to connect to vendors' sell-side systems transparently — accessing online catalogs and issuing purchase orders without leaving their native procurement environments. Companies that offer this capability differentiate themselves from competitors.

Integrating suppliers into the supply chain is nothing new. Many global enterprises have increased operating efficiency by requiring key players to adopt their integration technologies. Batch-oriented EDI messaging has typically been used to link organizations and, despite some limitations, has been adequate to the task.

Customer integration is altogether different. First, customers expect sellers to conform to their integration methodologies. Second, e-procurement application providers promote access through their particular pathways. Finally, real-time communication is critical because shoppers create purchase requisitions by searching for items online. Connecting to this ever-changing environment presents technical challenges and tremendous business opportunities — including significant gains in top-line revenue, improved operating efficiency, and stronger competitive differentiation.

SOA Enters the Picture

A Service Oriented Architecture, or SOA, has everything to do with this scenario because SOA's goal is to facilitate connectivity between systems. In fact, Gartner says that most Fortune 500 companies will implement some form of SOA-based solution in 2007. Its analysts predict that companies will build Enterprise Service Buses (ESBs) that expose key information to certain business processes, and their first efforts will be to facilitate intra-company communication.

We believe, though, that the more significant opportunity for process-level integration lies beyond the enterprise walls. Consider, for example, that thousands of customers need pricing and product availability information, yet most organizations focus initially on making relatively obscure data elements available that only a few internal systems can consume. It's hardly surprising that many SOA initiatives have delivered less-than-hoped-for results.

Today, however, an emerging on-demand integration solution, Integration-as-a-Service (IaaS), is awakening interest in customer integration. Just as Software-as-a-Service eliminates the upfront costs, implementation, and maintenance associated with the licensed software model, IaaS shifts the burden to a single expert vendor, freeing players from dealing with the nuts and bolts of the actual integration. Essentially IaaS applies SOA capabilities to a company's enterprise architecture (EA) layer, dramatically reducing the complexity and long-time horizon involved in connecting each individual trading partner.

Enabling SOA

IaaS mediates the differences between a company and its customers, allowing all participants to exchange information via their customary formats without requiring changes to business processes.

For companies that have established an SOA or made significant progress in that direction, IaaS exposes selected services to the service provider's cross-enterprise ESB. The provider maintains strict governance over services, delivers real-time connectivity with trading partners, and provides secure communication — enabling in-the-moment information transfer.

IaaS virtualizes inter-company connections. For example, IaaS enabled an appliance manufacturer to build closer relationships with chain retailers through up-to-the-second pricing and availability information. This allowed the retailers to maintain low inventory levels while enjoying the benefits of large on-hand quantities. The results? Increased velocity through the channel, big efficiency gains for the retailers, and substantially increased revenues for the manufacturer.

For companies that have deferred an SOA initiative, IaaS can provide Web Services and a stable secure cross-enterprise ESB that supports information exchange across heterogeneous systems. IaaS is a low-risk, cost-effective way to jump-start an SOA implementation.

Implementing Customer Integration

When integrating suppliers, an enterprise should consider its goals and how it wants suppliers to meet its standards. Customer integration, on the other hand, forces enterprises to evaluate their plans from the customer's perspective, making agility paramount. An IaaS-delivered SOA enables a rapid connection to customer business processes — in their native environment — and the ability to respond to varying business and technical demands.

This brings us to scalability, another critical consideration. Demand for cross-enterprise integration surges in response to new business opportunities. This situation strains most IT organizations because it's difficult to adjust integration staffing levels to fluctuating business needs. IaaS solves this problem by leveraging an already built-out infrastructure solely dedicated to integration and management by trusted integration experts.

Finally, IaaS accommodates even legacy integration technologies — such as EDI and secure file transfer — while supporting newer high-performance protocols and Web Services.

Best Practices

Enabling SOA through IaaS is very different from a typical enterprise software implementation, where companies must embark on a lengthy planning, deployment, and customization cycle.

Avoid Long Buy-in Cycles

IaaS doesn't require extended executive sponsorship, endless meetings, facilitated workshops, or any of the other components typically associated with enterprise-level application implementations. Rather, a knowledgeable service provider works with key company resources, and integration proceeds rapidly and unobtrusively.

Identify Customer Partners

Above all, it's a numbers game. When deciding which customers to onboard first, choose those that produce the highest transaction volume — Pareto's law applies here. That is, 20% of customers usually account for 80% of transactions, so they

SOA & Customer Integration in Action

The B2B division of a leading online and brick-and-mortar bookseller knew that it needed to significantly improve customer integration to grow sales. In a number of instances over the course of several years, field salespeople had called on large accounts who delivered the message loud and clear: your company makes it too difficult to do business with you.

Part of the problem was rooted in a lack of internal resources. The division's IT group had undertaken a few customer integration projects in the past but couldn't handle more work. Adding to the frustration, some of these projects were wasted effort, because the systems the group had so painstaking integrated disappeared from the market. IT knew that the company needed to work with customers whose technology was at varying levels of sophistication. Some customers had moved to Service Oriented Architectures (SOAs), which would make it significantly easier to exchange data, but many customers hadn't.

Given its resources and understanding of the work involved in integrating a disparate customer roster into its procurement system, IT decided to seek a solution outside the company. After a careful evaluation of the marketplace, the company chose Integration-as-a-Service (IaaS) because of its demonstrated ability to support large account business development and deliver cost savings. Decision makers were impressed by an easy-to-understand pricing model and rapid deployment as well as by their ability to amortize costs over a growing customer base.

In the months after deploying the IaaS solution, the company closed deals with most of the large accounts it targeted, automated nearly 95% of the orders, and dramatically improved the customer experience. In addition, the company retained 100% of all integrated customers that it onboarded.

IaaS has proven to be a strategic component in the retailer's positioning. It's boosted revenues by more than 20%, reduced the cost of integration by over 50%, and delivered a high degree of agility, which allows the company to respond to integration needs as business opportunities emerge.

should be targeted first. The next group — and there may be overlap here — are those whose transactions contain a high level of exceptions. The system kicks these transactions out, perhaps because business processes don't mesh comfortably, and it takes significant manual intervention to complete them.

For example, one customer's requisition contains three line items for the same product, probably because different purchasers were involved. The seller can't process the requisition in that form. The IaaS provider's system seamlessly consolidates the three line items into one when transmitting the information to the seller's procurement system and deconstructs the line item when acknowledging the order. Both companies get the exact information they need in the "right" format, and transactions proceed smoothly.

Measure Success

Integrating customers through IaaS-based Web Services offers powerful benefits. This is demonstrated by key metrics and the solid business improvements experienced by early adopters. Companies adopting IaaS will want to track:

- **Top-line revenue growth** – Companies are reporting a 25% revenue premium from integrated customers. Because costly manual steps are removed from the purchasing process, both accuracy and timeliness improve. This sets an organization apart from the competition.
- **Greater profitability** – Companies are experiencing as much as 10% margin growth from integrated accounts. Sales teams can focus on value-add activities such as understanding customer needs and selling to them, rather than chasing lost orders or other non-selling activities.
- **Improved customer relations** – Better customer integration leads to greater accuracy. Pre-validated requisitions, for example, move orders through order management systems quickly. This efficiency contributes to a better customer experience and increased customer loyalty.
- **Reduced integration costs** – Deploying IaaS can decrease integration costs as much as 50% and free IT resources to concentrate on the core business.
- **Increased integration speed** – A well-designed and managed IaaS solution can reduce the time required to integrate customers as much as 10 fold, because it leverages a proven SOA-based platform.

An Ongoing Strategic Focus

Though business integration is usually associated with tight supply chain linkages, IaaS lets companies use SOAs to respond to customer needs quickly and efficiently regardless of underlying platforms and technologies. Enterprises in many verticals can use IaaS to build closer, more profitable relationships with customers, while saving time and reducing the costs of traditional business integration solutions. IaaS, a low-risk extension of SOA, delivers the tangible business benefits that elude many emerging technology solutions.

IaaS lets companies enable robust customer integration at the data and business process levels. With IaaS, a supplier can connect to virtually any customer using any procurement solution without forcing changes in data formats or business processes at the buying end. The essentials of the exchange — shopping cart, order, invoice, tracking numbers, etc. — are transformed by the integration service, and neither side needs to be concerned about the technology deployed by the other. ■

About the Author

A recognized expert in building highly scalable, transaction-intensive applications, Andrew Dent founded Hubspan in 2000. The company is built on his vision — pursued throughout a career of more than 15 years of technology and business innovation — of improved information exchange among enterprises. At Hubspan, Andrew is responsible for architecting a world-class integration platform that delivers significant business value to Global 2000 enterprises. Before founding Hubspan, Andrew was CTO of 7Software, an e-procurement application provider acquired by Concur Technologies. Remaining at Concur after the acquisition, he guided the technical and strategic development of Concur Markets, a supply chain integration solution. Before co-founding 7Software, Dent spent five years at Microsoft where he was involved in the design, development, and customization of the vertical applications that ran Microsoft's core enterprise functions, including its CRM and SAP platforms. In this role, he was the architect responsible for designing and developing the industry's largest e-procurement deployment. Dent has a BE in computer systems engineering from the University of Queensland in Australia.

The Impact of Web Services on the IT Industry *—continued from page 16*

have also reduced costs, because companies can incorporate vertical functionality into their solutions without the investment in building it. Management views Web Services and SOA as a way to save money and avoid investing in new technologies and development efforts, choosing instead to exploit existing solutions.

Savings aren't often immediately apparent, and in truth many SOA initiatives are too new to provide any quantifiable reductions in cost. Yet the adoption of Web Services — which thanks to their decoupled nature encourage reuse — and SOA initiatives are increasingly seen as avenues to saving money by reducing overall development costs.

Conclusion

The advent of Web Services and SOA models are compelling software vendors and enterprise IT organizations to re-evaluate how applications are defined, developed, and used in an enterprise environment. Companies are already realizing benefits such as greater agility, cost savings, and more streamlined requirement analysis and development processes through the adoption of Web Services–based initiatives.

As companies continue to seek solutions that increase agility and provide greater connectivity with a wide variety of users and systems, the Web Services and SOA models are certain to continue to grow in popularity.

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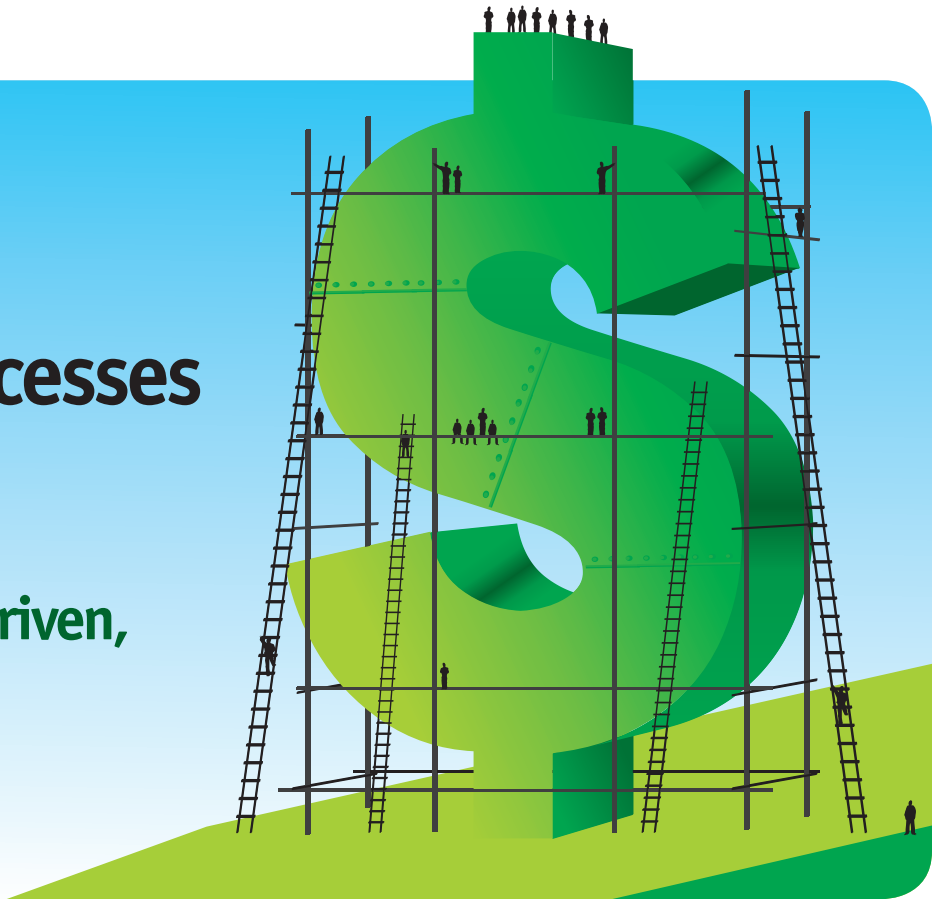
Building Intelligent Business Processes into SOA

Real-time, event-driven, and intelligent



WRITTEN BY **CHARLES NICHOLLS**

In our daily personal interactions with businesses of all sizes we all experience sub-optimal business processes. How many times have you tried to buy an item of clothing only to find that the store doesn't have your size? Then when you ask the shop assistant, he responds that a new delivery is expected on Wednesday, but he doesn't know whether that particular item will be included. Check back on Wednesday? Familiar? Of course, we're all so used to these kinds of experiences that we accept them as normal.

From a business perspective, even if it's the norm, it's far from optimal, and the effects are significant: Customers feel that the organization doesn't value their business and that service is poor; products are replenished based on assumptions, leading to stock-outs, loss of revenue, and customer frustration; prices are fixed even when demand is fluctuating wildly, leading to revenue not being maximized; customers churn due to unresponsive organizations that fail to react when poor service is delivered.

These are just a few day-to-day examples of sub-optimal business processes and their consequences: the revenues that are lost and the opportunities missed as a result. It's not hard to find many more examples in almost any business environment. You probably have your own personal pet frustrations that could fill this article.

So how can these kinds of processes become smarter? Before we answer that question, let's look more closely at the characteristics of an Intelligent Process.

Intelligent processes are created through the automation of repeatable, operational decisions by embedding business intelligence (BI) into those processes. But using BI tools to create intelligent processes is far from standard in most organizations today, where operational processes are typically disconnected from analytic processes.

Predetermined business rules and business process logic don't adapt automatically. When the business changes, the logic doesn't adapt. The business process isn't tailored to the individual process instance either, for example, treating different customers differently based on their unique behavior. The result: rigid policy-based approaches that don't treat different processes' instances in a relevant, personalized, or responsive way.

Intelligent Processes Defined

Intelligent processes are relevant, personalized, and responsive. To accomplish this, they need to draw on both real-time and

historic data, evaluate the current in the context of the historic, and then trigger other processes.

You wouldn't drive your car with a fuel gauge based on the amount of fuel you had last week, or with a speedometer reading based on the average last month. However, that is exactly how business operations are run today.

Process steps must be relevant to the context of the specific process instance being executed. Since businesses are continuously changing, in practice this means that the process needs to provide real-time visibility to call on real-time data so the latest status can be used. This may include process-state data, such as a real-time measure of supply and demand, or a predicted value, such as a delivery date for a shipment of goods. This data needs to be completely up-to-date or "latest state."

By definition this is a real-time need; the data must be immediately accessible and available to any service that needs it. But to optimize operations, you need to measure at the lowest level of detail, monitor the measurements by comparing them to "normal" or predefined goals to immediately correct problems or automatically take action. This effectively eliminates traditional BI approaches from consideration for use in SOA environments because older tools rely on querying historic data in data warehouses.

To complement real-time data and put it into the proper context, processes also have to be aware of the history related to the customer, product, or supplier involved to be able to personalize the process. This historical data helps the BI service make real-time decisions about the best way to treat a particular customer or product.

For example, if a product is selling significantly faster than normal, the process needs to compare normal sales and the selling process with the latest values. Should the system adjust the reorder quantity? To make an appropriate determination, it has to be able to consider such factors as to whether there were shortages last week and if the spike in demand is temporary. Or it could be that the item is on sale. Factors such as these affect how the process should branch according to analysis of the situation.

Finally, processes must be automatically initiated when significant changes occur that affect any customer, product, or supplier. For instance, if a retail bank customer makes a series of unusual checking account deposits, this may signal an event such as a house purchase. This signal can then be used to trigger a cross-sell program for a mortgage. Or if a rental car company knows that large vehicles are renting faster than usual in one location, it can increase the price to capture higher revenues.

In practice, these three characteristics — relevance, personalized, and responsive — define how processes should use data or call on a BI service to make smarter decisions. This analysis capability has to be embedded as part of the decision-making workflow.

Building Smarts into Processes

The way that organizations build applications has gone from database-centric to middleware-centric. Reliance on middleware and other integration software is critical because it allows for the construction of loosely coupled, modular services that deliver real-time, integrated, flexible applications.

This fits well with the business case for investing in SOA, which is typically made around three key benefits: visibility into business operations, process agility, and real-time integration of business processes.

It's crucial that companies recognize, however, that simply building an SOA won't by itself make processes any smarter. Simply automating a dumb process means that the company now has an automated dumb process!

So before companies begin constructing an SOA, they have to consider how they're going to provide business intelligence and what kinds of BI services can integrate with the SOA environment.

Traditional BI strategies assumed the data warehouse was the source of data for analysis, but such approaches only allowed retrospective analysis of static data. Data warehouses are batch-based and rely on BI tools generating queries to fetch data. Not only are they out-of-date by the time data arrives, they usually don't contain process-state data and therefore make a poor starting point for in-process analytics.

Of course a BI tool can be presented as a Web Service, but this doesn't solve the problems of the underlying data being out-of-date, the database needing to be queried, and unpredictable response times. Moreover, the types of analysis needed in SOA environments don't fit SQL well.

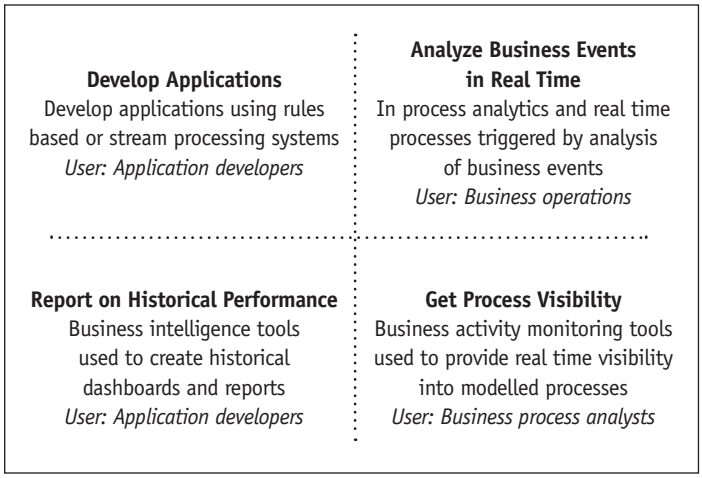


Figure 1: Different approaches to BI in an SOA have different characteristics, and different potential user communities. It's important to understand who your audience is and the tasks to be performed when planning BI

Figure 1 shows a matrix for matching user roles and functions to BI approaches in an SOA. This is worth thinking about quite closely: who is going to do what with BI, and when? Once you've answered this question, you can begin to consider the different approaches you might take. If you simply need reporting on processes after the fact then traditional reporting tools will suffice. But if you want to build analytics into business processes then you're into the realm of application development and real-time BI, depending on who the user is.

There are several new approaches to building streaming applications using Event Stream Processing (ESP) technology, which emerged from university labs. These provide stream-processing toolkits to IT – toolkits for developers to build ESP capabilities into the middleware layer.

Real-time Business Intelligence by contrast is used by business operations, not by IT, and sits on top of the middleware layer.

For BI to truly happen in real-time, the analysis of events needs to be "event-driven" in real-time and done in the context of history. It shouldn't be a query on a database. To be embedded in a process then a BI system must act differently. It has to be both process- and service-oriented.

> **Simply building an SOA won't by itself make processes any smarter – simply automating a dumb process means that now you have an automated dumb process**

It's important to understand that process-oriented doesn't mean process-based — the process doesn't need to be explicitly modeled in a business process management (BPM) tool. Rather, it needs to be oriented around optimizing the outcome of a particular process where the process itself may or may not be explicitly defined.

This process-orientation is a prerequisite for any closed-loop BI service, where actions can be automatically driven from the results of the analysis or operations staff alerted if the decision can't be automated. So both closed-loop and process-orientation are key components of BI in service-oriented environments.

Similar to the offline BI world the most interesting analyses in this new world are at the intersection of different services and processes. For example, the ability to analyze both supply and demand in real-time enables prices to be adjusted automatically, thereby increasing yield. In an SOA this has significant implications for your BI strategy if you want to build this type of intelligence into your processes.

Automated processes are driven by events; therefore, it's implicit that to create smarter processes, companies have to be able to view, analyze, and interpret events from across the service chain. This means analyzing data, event-by-event, either in parallel with the business process or as an implicit process step following a service request. You should usually expect that the events required will span multiple processes and services. Some of these processes may be modeled in Business Process Management tools, others not. In some cases the data will come directly from the Enterprise Service Bus (ESB) and in others it will be tightly integrated with one or more service requests.

So if you're using more than one kind of middleware, different rules and BPM technologies across your business then a common and independent BI service becomes an essential provision.

Middleware-centric Architecture Allows Stream Analysis

Service-oriented analysis is also fundamentally different than traditional query-based analysis since it's sequential rather than batch-based. Sequential analysis analyzes data as a stream "in flight" by tapping into the Enterprise Service Bus or enterprise application integration (EAI) software to compare each event, as it's happening, with historical patterns to determine whether a problem or opportunity exists.

This kind of analysis is particularly relevant to in-process decisions and is difficult to achieve in a SQL-based environment. A process might need to assess the impact of an individual event, a combination of events, or compare a current event with a historical "normal" — all of which can be challenging with SQL.

For example, a common requirement is to be able to detect when a particular customer is spending less than usual for an hour and day of the week or month. To do this, businesses have to be able to calculate, for example, the average order value for product X for customer Y in the last hour, for each hour of the day, and then compare this with the average sales for customer Y over the last three months for that hour and day.

To run this calculation continuously for every customer transaction, in real-time, when a business might have 30,000 products and 10 million customers is clearly beyond the capabilities of BPM and rules technologies.

Turbo-charging Business Rules Engines and BPM

Business Rules Engines (BRE) and Business Process Management (BPM) tools are often a significant part of your overall SOA implementation, and it's here that the business and process flow logic is defined. But due to the nature of these technologies, they're not designed for analyzing streams of data in the way that real-time BI is.

Often real-time BI engines are used alongside rules engines to provide additional fine-grain enrichment to the procedural rules defined. This can take several different forms: the rules engine can use real-time metrics as "asserted facts." Often these look like fine-grain real-time product or customer metrics that replace coarser estimates or averages. Examples here include velocity metrics, real-time measures of demand or service capacity, individual product sales, estimated delivery times based on calculations, and so on. Equally, since these event analysis technologies can detect significant events, they are also used in conjunction with BRE and BPM tools where the event is triggered to initiate a process or rule set. An example of this would be to initiate a customer retention process based on subtle changes in behavior by one of millions of individual customers.

Planning for BI in SOA

All SOA implementations will need some form of BI to fulfill objectives such as achieving greater business flexibility, information and application reuse, and real-time integration of business processes, so organizations need to plan for incorporating those capabilities from the outset.

For example, if a company will have to analyze a sequence of service requests that make up a process chain, it will need a common unique identifier in each service request. The organization only needs this for BI purposes, but it's clearly more efficient to build this in when the SOA is being designed than to try to retrofit it later.

Different software, middleware, and integration products have different ways of interfacing with the other components of an SOA, so it pays for organizations to consider how they will integrate them all.

Just as application architectures have changed to embrace SOA, BI is changing by becoming a real-time event-driven, intelligent service. Rather than reporting on the effectiveness of processes after the fact, BI can now, when properly integrated into an SOA environment, be used in the process to route workflow and support decisions in real-time, as customers act. ■

About the Author

Charles Nicholls is the author of "In Search of Insight" and founder and CEO of SeeWhy Software (www.seewhy.com). He incorporated SeeWhy in 2003 to create a new generation of business intelligence to revolutionize the way organizations analyze and use data. His book can be downloaded at www.seewhy.com/ebook

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