Increasing business value by reducing connectivity complexity
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WebSphere. software

Driving business agility through SOA connectivity and integration

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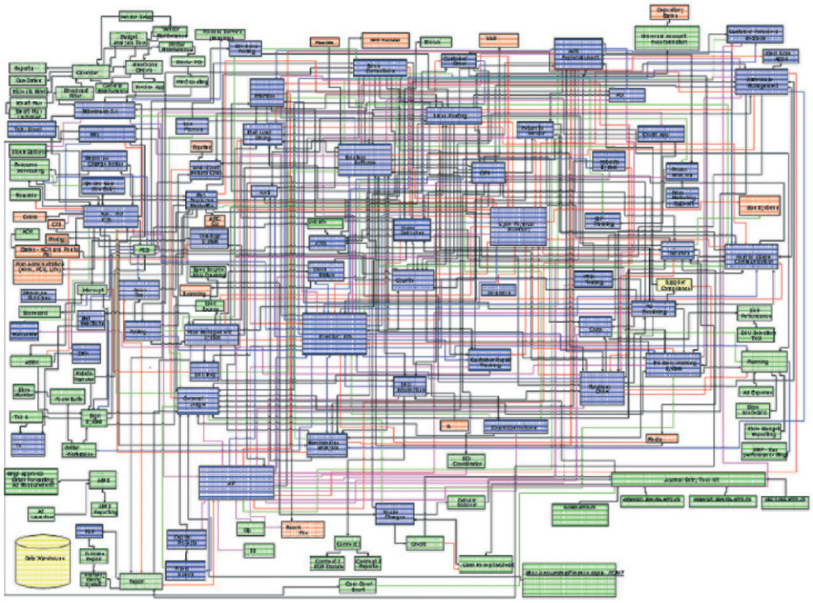
Introduction

Business challenges are increasing for every industry almost everywhere—from pervasive globalization and competitive markets to tightened credit and volatile commodity availability and pricing. To be successful, companies must be able respond to change quickly and cost-effectively. They need to be proactive by working smarter so that they can solve the problems of today and seize the opportunities of tomorrow.

For years, IT departments have been building infrastructures that support the sometimes conflicting and always complex needs of their businesses. Now there is even more pressure on IT to solve today's business challenges. Businesses that have built powerful individual solutions are beginning to realize that the costs and complexity of today's IT solutions could hamper their ability to be more responsive to changes in the market.

Many enterprises have been rigidly structured into virtually proprietary and separate vertical lines of business, sharing no common processes or parts of the infrastructure with other departments. This structure aided business control and direction for each line of business, but it prevented other departments (and the corporations themselves) from reusing any components.

This kind of vertical structure also leads to duplication of IT effort and an increase in costs. It also prevents businesses from quickly and easily sharing valuable information. Thus, existing IT architecture and solutions can become part of the problem to be solved rather than the tool to help businesses embrace change.



Today's business architectures have become too complex and unmanageable.

Today's business depends on a dynamic combination of assets to provide new intelligence and value and to gain market rewards. As business processes define the actions that a company will take, they differentiate that enterprise from others in the market. However, efficient implementation of those processes requires aligning the people in the business, customers and partners, and the IT infrastructure that implements and coordinates the steps of each business.

This paper describes some of the business and IT issues that enterprises must address to become more agile and to improve their responses to challenges and opportunities. We will explore how a service oriented architecture (SOA) can help an enterprise align its IT infrastructure with business needs, and the role of connectivity and integration as part of an SOA in that process. We also address the IBM SMART SOA™ approach to solving the connectivity problem and how solutions featuring IBM WebSphere® offerings can help deliver the desired business benefits.

Responding to changing business challenges and goals

In business, change is inevitable and constant—inside and outside a company. Customers, competitors and regulations change. Even the world seems like it is changing every day. How can you ensure that your business not only keeps up with change, but outperforms the competition by working smarter?

In any enterprise, keeping up with and embracing change—and even driving it—requires improving processes so that they are more dynamic, while also improving the underlying IT infrastructure so that it can provide new intelligence and direction. Progress in any part of a business can be bottlenecked by slow or no movement in another supporting area. For example, as new market opportunities arise, a company will want to move quickly to address both new and existing resources to make the most of the opportunity. However, any new investment might be wasted if either the existing infrastructure needs to be bypassed and duplicated or changes to that infrastructure take too long or cost too much for it to be an effective part of the new market solution.

If, however, the IT infrastructure were flexible and agile—ready to embrace change in whatever form it comes—it would be simpler to maintain and could help an enterprise exploit new business opportunities. Enterprises always want to reduce costs and take better advantage of new opportunities. Therefore, looking at the state of the existing and new IT infrastructure and how well it handles change is a straightforward step that should deliver both short and long-term benefits.

Improving the IT infrastructure to meet new business needs

How can you improve your IT infrastructure and make your business more dynamic, breaking the ties to vertical pillars that are matched to line-of-business solutions? A well-established, successful approach is to disengage the links between pieces of the IT infrastructure so that they can be viewed, accessed and used based on the functions they provide rather than the functions that they serve or the reasons they were deployed. Basically, the key assets in the IT infrastructure are then callable services rather than deployed applications.

Decoupling assets from the specifics of their implementation directly addresses a key problem with IT: the complexity caused by too many interfaces and interactions in application programs. It helps businesses become more flexible and dynamic because they are underpinned by agile IT resources rather than cumbersome applications. These resources not only can be reused in new ways to address new opportunities but also can be managed and maintained more efficiently for existing uses. This approach is the foundation of SOA, which groups functions around business processes and packages them as interoperable services. SOA in turn is the basis for improving IT infrastructure so that it meets a company's new and changing needs. Companies that are serious about using IT as a means of becoming more agile are moving to SOA.

Moving to an SOA-based strategy gives businesses a robust, reliable and flexible approach to designing and implementing reusable IT assets that are connected in a simple, flexible environment that is capable of spanning the enterprise and beyond. This approach enables businesses to reduce maintenance overheads on existing infrastructure, and it enables them to add new assets—anything from large systems to millions of sensors. Enterprises can replace existing assets without requiring major changes to applications, making the business more responsive and better able to meet customer needs.

Connectivity issues

In traditional infrastructures, as the number of applications multiplies, the number of interfaces for accessing each application grows. If the individual programmers use what they think is a straightforward and simple mechanism to connect, they typically tie it specifically to the implementation of each application and the current network deployment. As new applications are added that must interface with the first, and as changes are made to accommodate these dedicated connections, interfaces multiply and become more complex. Over time, these connectivity interfaces can overwhelm the application business logic itself. The IT infrastructure grows increasingly complex and costly, miring the IT department in interface maintenance rather than building new assets or improving existing assets.

As we stated previously, many businesses have addressed this complexity by decoupling the implementation of applications and the connectivity between applications. This approach has helped address problems within individual application environments, localized within departments. However, as rapidly changing markets demand wider resource sharing across the enterprise, businesses increasingly need to respond by breaking down the barriers

between lines of business so that they can make better use of their resources. Now, the approaches used in the past to decouple and share resources within departments are no longer sufficient to manage the flexible, dynamic resources that will enable businesses to embrace change.

How then do you decouple assets, not just locally, but enterprise-wide? And how do you do it in a way that makes your business more flexible, more connected, more intelligently aware of what is happening and more manageable? How do you ensure that assets are connected not only to exchange information but also to enrich that information? How do you ensure that your new dynamic enterprise and its supporting services provide rich capabilities, business visibility to services, and governance to everyone who needs them, both inside and outside your enterprise?

The foundational connectivity and integration solution for SOA is based on the simple approach of messaging, already well understood and used today by thousands of businesses for billions of transactions per day.

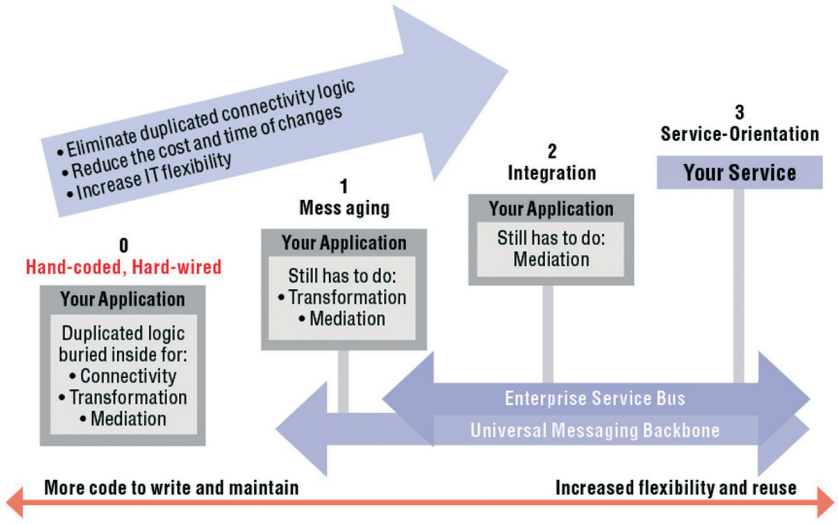
Messaging at the heart of SOA connectivity

For years, businesses have been using messaging-oriented middleware (MOM) to decouple the connections between their applications and systems. The principle behind MOM is that, instead of connecting and directly exchanging information with each other, applications send information over an indirect middleware layer. This layer packages the information to be exchanged as a message and moves it through a queuing system to send it to the receiving application.

With messaging-oriented middleware, such as IBM WebSphere MQ, an application uses a simple application programming interface (API) to send a message by moving the data into the messaging middleware environment. The receiving application then uses the same API to retrieve the data from the MOM environment. Thus, the application programmer can rely on the messaging environment to deal with all aspects of transmission failure and error-handling, and the application can focus purely on the business logic.

The nature of the messaging system also enables the programming logic to be asynchronous. Applications can be freed from waiting for a response or checking whether the receiving application is available or has confirmed that it has received the message. With all this checking for success left to the messaging middleware, programming resources are freed up and applications are simplified, all while maintaining reliability and manageability for the connection.

Using an indirect connection, through the messaging layer, means that the sending and receiving applications can be coded very differently, using a much simpler approach to architecture. Instead of business logic for each business function being tangled up with the inbound and outbound connectivity interface, each function can be coded cleanly. It can then be invoked independently by multiple different applications, systems and services. Clean coding vastly increases the possibilities of reuse, which can increase the business value of the application, the return on investment and also the ability of the business to be more responsive to change.



Simplifying business applications by decoupling connectivity through messaging and ESBs

WebSphere MQ

Since 1993, WebSphere MQ has been the leading choice for MOM, offering assured, once-and-once-only delivery of messages between applications and systems on virtually every commercial IT platform. It is used as the fundamental messaging backbone for mission-critical environments by customers in most regions and industries. WebSphere MQ is available on more than 80 platform configurations, offering standards-based APIs and proprietary approaches for maximum programming flexibility.

WebSphere MQ enables companies to connect applications using a *point-to-point* messaging approach. Applications can be coded specifically to move messages from one application to another. However, coders can take advantage of WebSphere MQ to simplify the interface and other logic that

otherwise would be required by the application to manage the connectivity. Many thousands of businesses have been doing this to remove business risk from their application connectivity. And the nature of their applications that use WebSphere MQ has provided them with an ideal first step for the move to an SOA.

Transactional exchange of data

One of the fundamental capabilities of WebSphere MQ is how it acts as a transaction manager. As described previously, WebSphere MQ is used to send and receive data between applications. However, take the case of a bank moving money between two accounts, or a travel agent booking a seat on a plane. Either of these circumstances requires a transactional exchange of data. It is critical that 1) information moves and both sides of the exchange are updated with the new state, or 2) nothing happens.

You do not, as a business, want to move money from one account to another, and have the same money credited to both accounts. You also don't want to try to reserve a seat on a plane, and fail, yet have the plane's ticketing system see a seat reserved. Avoiding such errors requires a transaction manager. WebSphere MQ is built on top of a transaction manager, so that messages are moved as part of a transaction. This gives a business a level of assurance that the message will be moved once and once only, with no degree of uncertainty, no need for duplication and no requirement for additional logic in the application for verification.

Although a high level of transactional management is appropriate or necessary for many forms of information exchange, many other message types are transient and do not require transactional control. For such messages, WebSphere MQ can be configured to allow a lighter approach to assured

delivery and to apply message persistence. For example, when an account balance is being requested, or airplane seat availability is being queried, there is no need for any transactional locking, and if required, the same message could be sent repeatedly. Therefore, WebSphere MQ can take a more lightweight and simple approach to the exchange of messages so that the message is sent faster, with less overhead and less impact on overall system performance.

Persistence

When any transaction can be critical for your business or your customer, you need absolute assurance that even system failures will not affect the handling of the customer data. As part of the transactional support provided by WebSphere MQ, each message can, if required, be persisted, or written to disk, as a way to maintain the integrity of the information during the movement of the message. This preserves the message and completes the transaction without losing data if a failure occurs at either end during the transaction. Persistence is fundamental to the ability of WebSphere MQ to assure once-and-once-only delivery of messages without burdening the application with complex error-handling code.

Publish/subscribe

As businesses look to extend the application simplicity and flexibility that result when WebSphere MQ provides the connectivity layer, some want to take the next step to even greater flexibility by using the publish/subscribe capability. This capability completely disengages the links between the sending and receiving applications. When using this approach, an application sending a message does not send it to a specific receiving application but rather publishes it with a topic description, and any interested applications can then subscribe to that message topic. Any number of applications from

anywhere in an enterprise can then receive and use the data, with no effect on the originating application. Publish/subscribe can significantly reduce needed maintenance updates to support new applications as well as increase the potential for reuse still further.

Messaging clients for extending access throughout the infrastructure

Some businesses deploying WebSphere MQ need to install and maintain code for a middleware layer on systems that might not be immediately accessible, such as kiosks, sales tills and even systems belonging to business partners. WebSphere MQ can be deployed as either a server or a client, and a recent feature in WebSphere MQ enables a zero-footprint client, with a Web 2.0-enabled browser capable of exchanging messages with WebSphere MQ. This configuration ensures that there are no practical limits to how much of the IT infrastructure can be connected using WebSphere MQ, allowing businesses to gain the benefits of decoupled applications and reusable service more widely than ever before.

Decoupling the links between applications with WebSphere MQ is a straightforward first step to take on the road to SOA. Each application and system can in turn be configured to use the messaging environment.

Beyond simply moving data: Enriching and mediating services to integrate the enterprise

WebSphere MQ moves data and files without reading, understanding or changing the contents of the message being moved. In many parts of the business that is all that is required. Data on one system under the control of one application is simply required in the same format on another system for an application designed to use the same data.

In the same way, even if a business moves a file with WebSphere MQ, the file will be moved with assurance, but there is no assurance that any application on a remote system will be able to make use of the file or the data held within. However, increasingly in the services-enabled business environment, services need to be mediated and not just simply connected. As services exchange messages, or files get moved throughout a business, it is useful or necessary to do additional work on the data before it reaches the service endpoint. This work could involve reformatting, enriching or truncating the data. Having a flexible, configurable environment as part of an enterprise service bus (ESB) that can perform this service mediation is an essential part of the integration solution for an SOA.

Evolution from simple connectivity to SOA integration

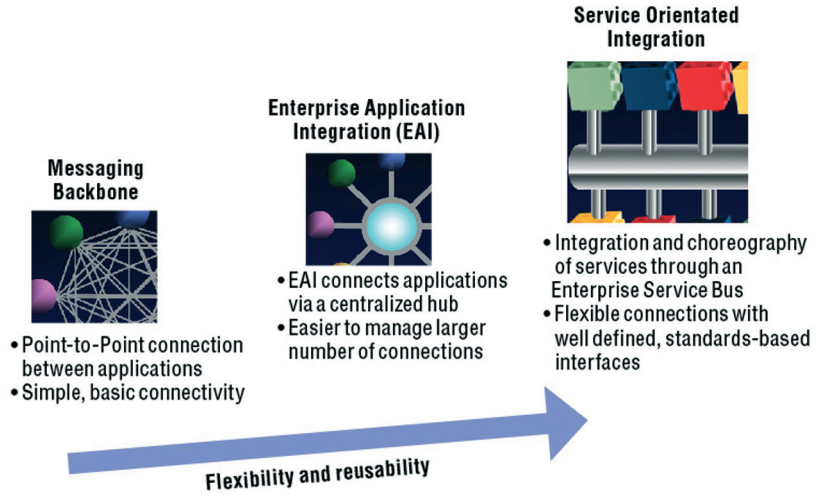
Since businesses started to connect applications there has been a need for interface logic to integrate the applications. This paper has already covered the importance of decoupling connectivity logic with a messaging middleware layer such as WebSphere MQ so that the applications are separated from the details required for reliable connectivity. If a layer such as WebSphere MQ is used to move data between applications, the applications themselves must not be burdened with logic for handling the message or data when it is exchanged.

Over time businesses have looked for ways to provide this application integration logic to connect applications that were not originally designed to communicate. A typical example is the deployment of adapters. Adapters sit in front of applications as a means of matching the connectivity method and data format to form a bridge between two differing applications. Typical of so many

IT solutions, adapters solve a problem, but create a new one if this solution is scaled up to address multiple different connections and environments. If separate adapters are required for each application to connect to every other application, the number of adapters rises as connection numbers grow. This increase becomes both a management and maintenance headache as programmers try to use multiple coding solutions to map application to application.

Eventually a solution to the problem of too many adapters was created, and companies began using a single integration environment known as an *integration broker*. It provided a robust integration environment, where the integration logic required between applications could be more simply defined and managed. *Normalizing* the data flowing between applications makes it faster and simpler to integrate the data with new applications because any connection can be matched to the normalized data format.

Integration brokers, generally deployed in a *hub-and-spoke* model, work well for many businesses to connect with the head office for processing needs. However, as businesses move to SOA, there is a push away from a more centralized IT deployment to a more widely distributed IT model. Such a model has reusable functions spread over the enterprise and offers the possibility of dynamic changes to usage models and deployments. In this environment, although the rules-based, statically defined connections in and out of the broker are still effective, they need continual adjustment to take advantage of new assets to locate and use.



Evolving application connectivity to SOA connectivity and integration

Integration in the SOA world

In a dynamic SOA environment, assets might be dynamically available, and processes might change regularly, requiring a dynamic infrastructure with rapidly changing composite applications. Just as assets used in mashups and composite applications are dispersed across the business, so too should the integration layer be more widely distributed. It needs to be available to provide more localized integration between services while continuing to do more traditional heterogeneous integration so that it provides a rich and robust mix of functions. This enterprise-wide integration layer is called an *enterprise service bus (ESB)*. This flexible connectivity infrastructure for integrating applications and services is something to plug into wherever the capabilities are required because of its transparent ability to connect a range of assets.

In an SOA environment, assets can be defined as services, which typically have interfaces that are defined in Web Services Description Language (WSDL). Having a shared, well-defined interface certainly can ease some integration issues. However, in most SOA environments, existing deployed IT assets are coded using a variety of differing approaches and a number of different industry and company standards. So, any ESB must be able to integrate newer assets with a standardized services interface and integrate existing assets with a more diverse set of interfaces. A business must also be assured that a move to SOA will not require a significant overhaul of existing assets, or the associated costs and risks will outweigh the benefits.

A custom approach to SOA connectivity in an ESB

To avoid the wholesale reprogramming of existing assets to enable SOA, which would negate the benefits, a common approach to SOA connectivity is for newer IT assets to be written as Web services, but for existing assets to be largely unchanged, at least initially. Existing assets can potentially be upgraded as needed to become services by adding a modernized interface to the existing application. However, with the power and flexibility provided by an ESB, another approach is for the ESB to define the application interfaces as services interfaces. Without changing the application, the reusable functions in each application will be visible and accessible as callable services by anyone in an enterprise. The ESB not only connects the services but also mediates them at the same time through the same interface. The services interact through the ESB, while remaining simple and reusable.

Note that enabling assets as services through a Web services interface is not the sole purpose of SOA. There can be benefits associated with service-enabling assets, but there are undoubtedly costs. From a business perspective, when an application presents already well-architected interfaces through a capable and flexible ESB, there is little motivation to do additional work to present the asset through a modernized services interface.

An ESB deployed to match the needs of the business

For a business taking the first few steps into SOA, there are likely to be one or two projects that become the trailblazers for the move to SOA. An existing department might have an overwhelming need for an overhaul, or a new business opportunity might benefit from the agility of an SOA approach. The business might be large or small, with a strong IT department or limited IT skills. Various combinations of these factors will generate projects that differ in scope, speed and end result. The environment always affects the project, and the background to the selection of an ESB as part of an SOA project is no different.

All SOA IT deployments need connectivity, and that connectivity is addressed by the selection and deployment of an ESB. Each project places different connectivity demands on its ESB. To select the right ESB for a given project, you should consider the characteristics of various ESB offerings based on the specific set of requirements for that project.

But how can a business integrate enterprise-wide with SOA if each project has its own criteria for selecting and deploying ESBs? After all, one of the key drivers for SOA is reuse of assets, specifically as a part of composite applications, and yet different departments require different ESB capabilities. But with each department hosting components that together form a composite application, cross-ESB integration is essential. When selecting an ESB, whether for specific departments or for an entire enterprise, you must balance individual project needs against the need to integrate with other connectivity selections to form an overall ESB.

IBM helps you make the right ESB selection

The awareness of this cross-department integration need drives much of the support for SOA infrastructure offerings today. IBM has made it a priority to address not only individual project needs with specific integration offerings

but also the end-to-end connectivity and integration needs of an enterprise. To this end, IBM has a portfolio of WebSphere offerings that deliver the connectivity required either for a single project, the first step to SOA or an enterprise-wide SOA deployment. These solutions work both on their own for niche requirements and also integrate to form powerful, comprehensive, end-to-end solutions for any business requirement. A prime example of this are the ESB offerings that are available as part of the WebSphere portfolio for SOA connectivity.

Because we understand that different businesses have different integration and connectivity needs, IBM offers three ESBs, each tailored to suit a variety of deployment needs. These ESBs can be deployed separately to meet individual requirements or in any combination to meet sets of different business connectivity requirements that span an entire infrastructure. IBM's three ESBs are IBM WebSphere Enterprise Service Bus, IBM WebSphere Message Broker and IBM WebSphere DataPower® Integration Appliance XI50. To help you select the right offering for a given situation, the following sections identify the strengths of each offering, how those strengths apply to specific integration project types, and the deployment environments for each offering.

A choice of ESBs from WebSphere combining messaging and service enrichment

Although all IBM ESBs are flexible and capable of integrating a business in many ways, each one is most useful in a particular environment. WebSphere ESB is well suited to integrating environments with a preponderance of standards-based applications and Web services assets. WebSphere Message Broker is a good match for environments that must integrate multiple different heterogeneous applications, including those environments that require an SOA-enabled infrastructure without substantial rework. WebSphere DataPower Integration Appliance XI50 is an excellent solution for companies that have a high level of XML data structures and a need for speed, and must deploy an ESB in a DMZ. The sections that follow provide more detail about each of these ESBs.

WebSphere Enterprise Service Bus

For some environments, new Web services will be written in and hosted by application servers such as IBM WebSphere Application Server. As part of an SOA, the availability of these services will span many systems as part of composite applications. These services need an ESB that is as available and accessible as widely as possible. This is the environment that is well matched to WebSphere Enterprise Service Bus.

WebSphere Enterprise Service Bus is built on top of WebSphere Application Server to provide an integrated environment for hosting and integrating services that meet local and enterprise needs. Because it offers this environment, it can be the ideal ESB for departments that are predominately developing or moving to newer services-based approaches, especially if the development team is familiar with Java™ and Web services.

Highlights

Key features of WebSphere ESB

- *Enhanced support for Web services standards*
- *Tooling for WebSphere integration developers, shared with WebSphere Process Server*
- *Platform-based ESB*
- *Tight integration with WebSphere Application Server and the rest of the WebSphere platform*
- *Ability to configure service mediations through policies*
- *Broad platform support, including native support for the IBM System i® platform*
- *Integration with IBM WebSphere Transformation Extender for universal transformation*

WebSphere Enterprise Service Bus as part of a wider integration solution

WebSphere ESB works well as a stand-alone ESB, but it can also operate as a part of a wider ESB that uses other ESB solutions to create a dynamic infrastructure that is further enhanced by additional integration approaches such as business process management. One of the key IBM solutions for business process management is IBM WebSphere Process Server, which deploys and runs processes that orchestrate services (people, information, systems and trading partners) in an SOA. WebSphere ESB is an integral part of WebSphere Process Server in the same way that WebSphere Application Server is an integral part of WebSphere ESB.

WebSphere Message Broker

WebSphere Message Broker has been available from IBM since 1998, under a variety of different names, and with an evolving set of functions. It uses WebSphere MQ as the underlying infrastructure and was originally designed to be a hub-and-spoke integration broker. This deployment model works well in an environment where remote locations must connect to a back-office hub to proceed with any type of processing. With its graphical flow model of programming and different integration requirements, businesses can use it to integrate different applications, whether they are standards-based or entirely proprietary.

WebSphere Message Broker can integrate virtually any system. It is fully customizable, but it also offers a large number of prebuilt integration components. It offers a comprehensive integration platform that enables universal integration between any application and any system because it can

send and receive messages using the built-in WebSphere MQ transport layer, or it can read and write from the file system or databases. It can even send and receive e-mail messages and take advantage of other methods of connectivity to provide the most complete integration platform possible. Recent extensions can locate Web services through registries such as IBM WebSphere Service Registry and Repository and build new Web services front-end interfaces to existing applications.

Many businesses are keen to become truly agile and present all their applications as connected services. This goal becomes much easier when all the key business functions are accessible as services to make it faster and easier to reuse key assets. WebSphere Message Broker can build the interface to an existing application invocation using a Web services front-end interface such as WSDL. In this way, all services that need to invoke this service through the ESB can access the asset as a native Web service, defined as such in a service repository. The result is better knowledge and control of IT assets supporting the business, whether these assets are existing applications, newly written services or even files or databases anywhere in the system infrastructure.

WebSphere Message Broker at the heart of the infrastructure

WebSphere Message Broker was originally designed to integrate applications running in the central IT infrastructure, so it is used to exchange messages at a high level of throughput to match the needs of the core IT assets in a business. Even large messages can be sent through and processed by WebSphere Message Broker, either in one piece, or broken up for faster processing.

Highlights

Key features of WebSphere Message Broker

- *Platform-independent ESB*
- *Advanced SOA and Web services support*
- *Integration without bounds with universal connectivity and transformation*
- *Single-click installation*
- *Single-click administration roll-back*
- *Broad platform support*
- *Powerful product tooling for enhanced developer productivity*
- *Starter-edition deployment option*
- *Remote-adapter deployment edition*
- *Trial version at no charge*

As businesses look to move to a less centralized SOA infrastructure, more processing is done away from the central IT hub and more assets are called to be part of composite applications to deliver flexible infrastructure to the business. Recent enhancements to WebSphere Message Broker have enabled it to act as a part of a wider enterprise service bus. In most deployments, the infrastructure will include a mix of different application types. Some parts of the infrastructure will have groups of applications that might be simpler to integrate using WebSphere Enterprise Service Bus. Other parts of the infrastructure will have combinations of applications that must be integrated with WebSphere Message Broker. In such cases, a combination of WebSphere Enterprise Service Bus and WebSphere Message Broker can handle these different applications. Both can integrate, exchanging messages and using the messaging environment of WebSphere MQ to preserve the transactional integrity of information moving from system to system in the less centralized SOA.

Whether you are deploying on a single system or taking advantage of the built-in scaling ability of WebSphere Message Broker for multiple systems, the burden associated with managing such a system can be reduced by managing it with WebSphere MQ. Because WebSphere Message Broker is built on top of WebSphere MQ, administrators can manage both environments with common tooling. Shared administration is a sensible way to reduce the effort associated with managing this type of widely spread environment.

WebSphere Message Broker is also available in several versions. The starter edition is available with limited message flows that provide the ability to start developing applications and message flows for an organization. The Message Broker for Remote Adapter Deployment provides ESB capability for hosting a remotely deployed Java EE Connector Architecture (JCA).

WebSphere DataPower Integration Appliance XI50

As previously discussed, organizations are adopting new operating models to achieve agility, including deploying reusable, open standards-based software components in an SOA. Embracing open standards, such as XML-based Web services, has helped many companies improve productivity, quickly respond to changing business needs and seize opportunities as they arise. To take advantage of the improved business processes, flexibility and IT efficiency that come with moving to SOA, many organizations require pervasive, scalable services and controls, robust security and high service assurances in their infrastructures. Today, enterprises often find themselves struggling to deliver these critical SOA requirements without having to handle prohibitive cost, complexity and hard-to-manage infrastructures. Addressing these challenges requires a pragmatic approach to SOA: one that simultaneously recognizes the evolution of standards, the value of existing infrastructure investments, organizational challenges and how performance can be affected.

IBM WebSphere DataPower SOA appliances extend the IBM SOA foundation with specialized, consumable, dedicated SOA appliances that combine simplified integration, superior performance and hardened security for SOA implementations. Meticulously augmenting all phases of the SOA life cycle and implementation, these highly specialized devices combine a host of essential SOA functions in a specialized appliance for easy deployment and service delivery.

As a core offering in the IBM ESB product portfolio, WebSphere DataPower Integration Appliance XI50 (XI50) is a hardware ESB solution that can quickly transform data into a wide variety of formats, including XML, industry standards and custom formats. The device provides core ESB functions, including routing, bridging, transformation and event handling. It provides a reliable, performance-oriented solution to many integration

challenges. Because it is not limited to handling just XML, the XI50 resonates with IT organizations that need to benefit from the connectivity of SOA deployments but must also deal with managing a combination of multiple proprietary, industry, company-specific and existing data formats. The device is a true drop-in integration point for such environments, reducing the time and cost of integrations and speeding the time to market for services.

The XI50 also offers the higher levels of security assurance certifications that are required by many enterprises, including financial services and government agencies. The combination of the high performance of hardware acceleration with simplified deployment and ongoing management means faster, more secure performance and fewer SOA programming skills, which can be an advantage when time to market for SOA is a critical requirement. Because it is versatile and easy to deploy, WebSphere DataPower Integration Appliance XI50 can be a reliable cornerstone for a resilient infrastructure. It appeals to a variety of groups with stakes in successful SOA deployment, such as enterprise architects, network operations, security operations, identity management and Web services developers.

For accelerated, secure integration capabilities, the XI50 provides transport mediation, routing and transformations among binary, text and XML message formats. You can use visual tools to describe data formats, map between different formats and define message flows. With native connectivity to IBM DB2® and IBM System z® technology, the device offers innovative, secure XML enablement of existing systems and mainframe connectivity. Also, when you move certain functions onto an XI50 (such as protocol bridging, Web services management, security processing and policy enforcement), IT

Highlights

Key features of WebSphere DataPower Integration Appliance XI50

- *Acceleration of existing integration hubs*
- *Mainframe modernization and Web services*
- *Appliance simplicity*
- *Any-to-any transformation*
- *Common tooling with WebSphere Transformation Extender*
- *Integrated message-level security*
- *Configurable quality of service*
- *Highly flexible scripting and configuration support*
- *XML enablement*
- *Wire-speed application integration*

architects, operations, security personnel and business personnel can disengage these functions from core business applications. This can simplify development, deployment and SOA manageability.

IBM recognizes that SOA must address the need to integrate heterogeneous environments both inside and outside an enterprise. The WebSphere DataPower SOA appliance portfolio has a long-standing history of support for key and advanced standards, including:

- *WS-Security*
- *WS-Policy*
- *WS-ReliableMessaging*
- *SOAP*
- *Web Services Distributed Management (WSDM)*
- *WS-I Profiles*
- *WS-Addressing*
- *Extensible Access Control Markup Language (XACML)*
- *Security Assertion Markup Language (SAML)*
- *Secure Sockets Layer (SSL)*
- *Proprietary Single Sign-on (SSO) tokens*

In addition, the XI50 supports interoperability with universal description, discovery, and integration (UDDI) registries, and such databases as Oracle and Sybase.

A connectivity solution is more than just an ESB

Using the ESBs we have just described, on their own or in connection with each other over a reliable transactional messaging layer such as WebSphere MQ, can provide an IT infrastructure with the flexibility needed to drive a dynamic business. However, the solution to the challenge of integrating the entire business involves more than simply putting an ESB in place to integrate IT assets.

Enabling applications and services to exchange data over an ESB without complex programming simplifies the applications but does not in itself enable a business to become more agile or allow the IT infrastructure to align itself with the business. There are not only aspects essential to the business to cover, such as security and management, but also aspects associated with increasing SOA value, such as detecting key business events, SOA governance and the dynamic location of service assets.

Aligning business and IT

A stumbling block for many businesses is the lack of an overall plan for controlling of IT and making sure that IT infrastructure matches the needs of business. When a company grows, the IT infrastructure changes and evolves as a response. New approaches, new systems, software, solutions and temporary fixes to problems rapidly become permanent. This sea of changes has created not only complexity in connectivity, but also a lack of alignment between the business processes and the IT implementation.

The issues of visibility and control of IT

In many businesses, substantial effort is required to map, step-by-step, business processes and their interactions throughout their life cycles as the business state changes. However, to improve the business, mapping—and then optimizing—processes is essential. A clear layout and understanding of

interrelationships helps you monitor, measure and review existing throughput, performance and effectiveness. The IBM Business Process Management Suite provides businesses with this function, offering a complete solution for modeling, deploying and monitoring business processes.

When a company tries to evaluate the design process for its IT infrastructure, a clear understanding becomes very difficult. With heterogeneous systems, different line-of-business dependencies and continual updates and replacements, things barely stay still long enough to be mapped, never mind measured. Without this measurement, the benefits of IT become hard to quantify. Changes are hard to identify and harder to control, and improvements that can keep up with changes in the business, especially wholesale restructures, seem impossible.

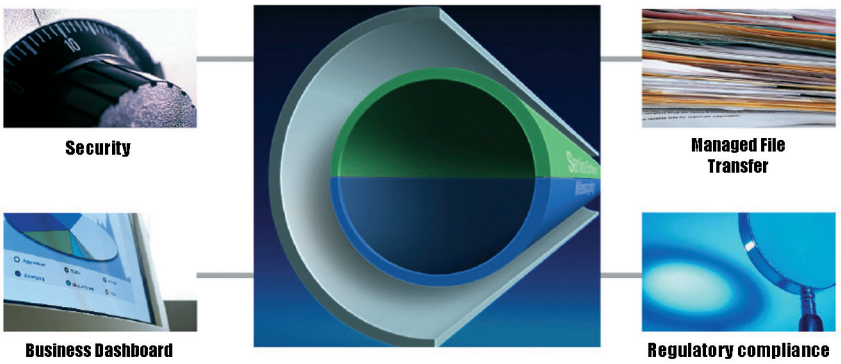
Business control through service mediations in the ESB

SOA is designed to break the cycle of IT infrastructure complexity by simplifying connections and using the results to improve the alignment of business and IT overall. When an ESB is the means of transport between assets, this change can be realized, along with greater visibility and control. As more assets are connected through an ESB—whether newly written, completely modernized, service-enabled or connected as an endpoint—the exchanges of information move through the ESB, and the ESB layer can be configured to act on these exchanges. These actions, generally called *mediations*, can act on the data, processing it so that it can be received by many different endpoints.

Mediations can also successfully perform a service request by providing the right security credentials from the requestor. By providing this support as a service available through the ESB, a business need not overcomplicate security by defining all possible users for every system and every asset. This type of access control to assets can also be used to implement business controls and tracking, through up-front policy-based control. Again, with mediations running in the ESB against every message flowing, decisions can be made about whether a user is not only permitted to use a function, but also whether that function fits the user's job profile. Maybe key tasks should be used only at certain times of the month. Perhaps a business wants to control when new versions of an application or data become available more widely across a system to reflect changing business needs. When all information flows across an ESB, and the business can take action based on that information in real time, the business is suddenly in greater control of not just information, but the entire IT infrastructure and the business itself.

Security, management and governance solutions from IBM

As described previously, an ESB that connects an enterprise provides a unique opportunity to gain visibility to business activity, monitor business and IT effectiveness, and enhance both IT and business governance. The first step to achieving these capabilities is the deployment of a reliable messaging backbone such as WebSphere MQ, and then extending the connectivity to provide flexible integration through one or more WebSphere ESBs. However, IBM can enhance SOA connectivity with a number of products that deliver additional business and IT control, increasing the business value of SOA.



Gaining better visibility and control of your business through an ESB

WebSphere Service Registry and Repository

Many existing IT solutions have no structure. Even if each individual component has been well designed, after it is deployed, it can sink into a highly complex infrastructure with too many other components. This complexity prevents a full understanding of how each component is used, both initially and throughout its life cycle. WebSphere Service Registry and Repository addresses this problem by solving a number of issues. One of these issues is publishing each service in a business, either manually or by discovering existing services hosted in the environment.

Businesses today can find it difficult to achieve reuse when applications are complex and there is no easy way to find what services are available. WebSphere Service Registry and Repository can solve these issues because it provides an environment that offers service location, both at build time and also dynamically at run time.

SOA governance for your business using WebSphere Service Registry and Repository

Making all services available for reuse could be a recipe for disaster. If access to and use of services are not controlled, parts of the business might refrain from making their services available for reuse through WebSphere Service Registry and Repository. Therefore, WebSphere Service Registry and Repository provides SOA governance. The function of SOA governance is to establish decision rights for the development, deployment and management of new services, followed by monitoring and reporting on decisions for communicating governance results. WebSphere Service Registry and Repository supports SOA governance of your applications, services and policies throughout their life cycle. Your SOA then can provide real value for your business, with all your high-value applications participating fully throughout their life cycle, enhancing reuse potential and providing a trusted source of applications and services. Without proper SOA governance, your SOA becomes brittle, inflexible, unpredictable and difficult to maintain.

Each phase of the service life cycle has different challenges that need targeted repositories. To govern the SOA consistently throughout all phases of the life cycle and yet cater to different user needs in each phase, IBM's strategy is to build optimized SOA repositories that federate service metadata. WebSphere Service Registry and Repository Advanced Lifecycle Edition provides an integrated design-time and run-time repository to govern the service life cycle from identification to consumption. It is a scalable, flexible and enterprise-level solution that puts the focus on visibility and control of all your assets and services, thereby increasing agility and reducing risk.

Managed file transfer for SOA with WebSphere MQ File Transfer Edition

Many organizations devote valuable IT resources to building and maintaining in-house systems for moving files between applications. Most of these solutions are based on FTP because of its simplicity and availability. FTP is well suited for file sharing, but many organizations are seeking alternatives for files that are moved between applications as part of business transactions. As volumes of transfers rapidly grow, and with increased consequences for errors in business data being incorrectly transferred, it is increasingly critical for organizations of all sizes to have a reliable, flexible, cost-effective solution for managed file transfer.

WebSphere MQ File Transfer Edition provides a reliable, managed file transfer solution for moving files and documents of any size between IT over a dual-purpose backbone that also handles messages. Files can also be transferred reliably to and from ESBs. This enables ESB capabilities, including mediation, transforming and routing, to be applied to files.

Secure, scalable SOA solutions with WebSphere DataPower XML Security Gateway XS40

Security is a key component of SOA governance. However, securing applications in a distributed SOA-based environment can require complex custom configurations and constant code patches deep within an enterprise. Add to that the challenge of keeping in step with ever-evolving Web services standards, and enterprises that depend on Web services and XML to grow their businesses can find an increasing amount of time and resources devoted to security.

The specialized hardware of IBM WebSphere DataPower XML Security Gateway XS40 (XS40), which was built by some of the world's foremost Web services and XML security experts, provides sophisticated Web service access controls, policy management and enforcement, data validation, message filtering and more. Because the XS40 is a self-contained security gateway designed to be shared by applications, it unifies and centralizes Web services and XML security at the edge of the network, with the added capability of acting as a Web services and XML firewall.

In addition to its built-in, highly configurable security functions, WebSphere DataPower XML Security Gateway XS40 also supports SOA governance and service visibility because it integrates easily with security and identity management software, such as IBM Tivoli® Federated Identity Manager and IBM Tivoli Composite Application Manager for SOA.

Secure your business using Tivoli Federated Identity Manager

In an environment where the IT infrastructure spans multiple systems, there is a compelling need for effective connectivity, as described in this paper. Securing these assets is essential. It has long been understood that the more connected an environment, the greater the security risk to an asset.

In an SOA, with its drive to connect and reuse greater numbers of assets, there is a need to tightly secure each system, application and service. However, this can prevent any type of agility, because, for every possible service interaction, each user who might request a service called as part of a composite application would need to be defined for each system involved. The problems this creates include high cost, out-of-date definitions, and difficulty proving controlled access in an audit.

IBM Tivoli Federated Identity Manager breaks this possible security spiral by simplifying application integration with user credentials managed by a stand-alone identity service tool. In place of defining all users who could possibly need interaction with any services asset, each security request is treated as a service request to the identity manager, which determines whether to enable or deny access. The approach not only ensures a reduced workload for application programmers, who no longer need to design and support complex security mechanisms, but it can also reduce the burden for security administration and audit, with a simpler environment and a single tool and location to monitor and manage. Changes that are effective throughout the enterprise are made easily, and use and abuse can be tracked and controlled.

Manage your decoupled IT assets with Tivoli Composite Application Manager for SOA

The greater connectivity and access provided by SOA can unnerve some administrators. As business and IT have moved away from central IT locations with large machines connected to dumb terminals, many administrators and system managers have found an ever-increasing workload and ever-increasing difficulty in managing the environment effectively. There might be a high level of concern that the move to SOA might create a system so flexible that it becomes unmanageable.

Service oriented architecture should reduce the management burden with a simpler IT infrastructure that can manage the IT environment to meet the business needs. However, the combination of middleware environments such as ESBs and SOA governance tools such as WebSphere Service Registry and Repository can provide not only better visibility to what is going on in the business but also more effective management and control.

Tivoli Composite Application Manager for SOA enables the management of services as first-class resources by using service flows for service problem identification and resolution and service management automation to help meet service level agreements and track issues immediately with built-in alerts. An integrated console provides access to tools for investigation and diagnosis of issues.

Think of being able to detect not only which assets are being used in the business, but also which assets are not being used. If WebSphere Service Registry and Repository is used with Tivoli Composite Application Manager for SOA, the business can track information such as which assets have been defined to WebSphere Service Registry and Repository but are not being used. It can also detect which services used in the enterprise have not yet been defined to WebSphere Service Registry and Repository. The combination of SOA management with SOA governance now means that system administrators and managers can provide better management of IT and better reporting to the business of what is happening throughout the IT infrastructure.

Extending access to partners and customers

Today, most companies want a combination of internally developed, customized capabilities to differentiate their business, alongside well-proven, externally written applications to deliver core business functions. However, this approach is effective only if the integration between the external packaged applications and the internal business infrastructure can be effectively and efficiently put in place. If this process is delayed, the return on each project is reduced, and the momentum to deploy such infrastructure successfully can be lost. Experience has shown that many enterprises find the challenge of integrating complex internal applications alongside sophisticated packaged applications daunting and time-consuming.

In addition to the challenges of integrating a diverse mix of internal applications and platforms, enterprises increasingly need to extend their applications and services to external entities, such as business partners, customers and vendors. The added complexity of dealing with heterogeneous environments that are neither visible nor under an enterprise's control can be an enormous stumbling block to becoming more competitive in an increasingly connected global economy.

WebSphere Adapters for faster, simpler access to applications

The SMART SOA approach from IBM provides a more effective way to integrate packaged business applications. The simpler connectivity infrastructure discussed throughout this paper can be used to combine internal and external functions with business processes and data contained in packaged applications. However, many packaged applications have complex interfaces and data structures, which system integrators must negotiate to invoke application functions or access business data. WebSphere Adapters help accelerate the task of integrating these packaged applications with the wider business infrastructure. When used with an ESB from IBM, WebSphere Adapters enable real-time access to packaged applications without writing custom code. With graphical tools for enterprise application and database discovery, interfaces can be created in hours as opposed to days or even weeks, as compared to writing custom interfaces. With WebSphere Adapters, reliability and performance are also much improved and maintenance becomes simplified.

Removing the barriers to connectivity beyond the enterprise

When businesses become more service enabled and more flexible, they can address all aspects of interaction. This means not simply connecting and integrating services and other assets throughout the different business departments, but also extending that connectivity and integration beyond the firewall to include integration and service mediation with business partners and customers.

Business-to-business (B2B) interactions have long been a challenge to businesses. As hard as it is to set standards for integration within a business, it is much harder to agree on and implement interactions beyond the bounds of the business. B2B interactions have for decades been some of the most complex and difficult to set up and manage. Obscure and impenetrable data formats have been used to save bandwidth, and each B2B partner is forced to try to send and receive data streams neither party is really happy with.

There is a related but different problem in interacting with customers. Maybe they want to see the status of their order on your systems, or check whether an item is in stock before they order it. Either way, there is another demand for access to systems and data, but this time driven by external user applications, most likely over the Web, but potentially through any channel.

So how does the new era of SOA, ESBs and service mediation affect potential solutions for B2B problems? Can ESBs themselves meet the needs of external businesses and customers through service mediations, links to agile processes and SOA governance? To a large extent the answer is yes. ESBs make a big difference in the ability of a business to extend its IT systems to multiple channels inside and outside the enterprise. And the move to greater service enablement and XML data structures greatly simplifies the challenge of trying to mediate highly complex data exchanges.

Extending IBM ESBs to meet the B2B challenge

Although implementing one or more of IBM's ESBs as the core solution for SOA connectivity and integration provides a good basis for integrating B2B exchanges into the IT infrastructure, these interactions can be accelerated with specific product offerings and solutions that aid the definition and ongoing operations of B2B exchanges. Some products that can be part of the solution include WebSphere Transformation Extender and WebSphere Adapters, both of which enhance the ability to mediate and process specific data types to connect disparate applications and services. However, there are two specific products that can be deployed as part of a B2B solution: IBM WebSphere Partner Gateway and IBM WebSphere DataPower B2B Appliance XB60.

IBM WebSphere Partner Gateway

Any exchange of information with external partners must be carefully agreed to and managed by both parties. WebSphere Partner Gateway helps trading partners manage their own profiles to ensure accuracy. After the profiles are defined, partners can exchange information using a variety of standards-based protocols and data formats that can be received through the gateway onto the ESB, which can further tailor the information.

IBM WebSphere DataPower B2B Appliance XB60

There can be many different profiles for information exchange between partners. Some involve complex conversational processes to agree on business steps. Others involve many high-speed data exchanges, perhaps providing constant status updates. Where the speed and volume of partner exchanges can be high, there might be impact on the receiving systems, especially because B2B gateways need at least part of the solution in the DMZ.

WebSphere DataPower B2B Appliance XB60 is an ideal solution for this scenario because its hardware is simple to deploy and offers hardened security and high performance, all suitable for rapid deployment and easy management in the DMZ.

Built on the strengths of the WebSphere connectivity portfolio, the XB60 supplements IBM's B2B industry expertise by integrating with WebSphere Transformation Extender Trading Manager and Industry Packs and with WebSphere Partner Gateway. Built on the strengths of WebSphere DataPower SOA Appliances, the XB60 includes ESB and security functions, and can be used to provide DMZ-based policy enforcement as a single, high-performance, secure entry point for all B2B transactions.

Mapping complex data with WebSphere Transformation Extender

IBM offers WebSphere Transformation Extender as a solution to the challenge of mapping complex data structures and industry formats. WebSphere Transformation Extender is a universal data-transformation engine that can solve the toughest transformation problems without programming. The transformation objects created by WebSphere Transformation Extender can be used to enhance ESB solutions from IBM by simplifying any aspect of data transformation required. WebSphere Transformation Extender even shares its transformation tools with WebSphere DataPower Integration Appliance XI50 to ease integration and reuse.

Available as an extension to WebSphere Transformation Extender are industry packs that provide assistance with:

- *Complying with government and industry mandates*
- *Integrating multiple systems and standards*
- *Accelerating the ability of the customer to make more efficient use of any data in the enterprise*

Applying your dynamic infrastructure to achieve a dynamic business

So far, this paper has covered the reasons for connecting and integrating IT assets and introduced IBM products that can provide these capabilities to a business. These changes to the IT infrastructure could easily be done for purely IT reasons. The complexity of existing solutions and the skills needed to build, maintain and manage such systems would likely drive IT to try to improve and simplify the architecture in the face of tighter budgets and increasing demands to demonstrate value. However, this is always balanced by the demand for more and more function and continuing changes to the existing solutions. SOA offers the chance to break the cycle, and can give IT the opportunity to simplify and improve the architecture while working smarter by delivering more capabilities to the business faster.

As previously discussed, at the heart of this solution approach for SOA is simplifying the connections using a reliable messaging backbone and an ESB. This enables applications and services to connect and exchange information reliably without the need for complex programming at the application layer. With all the information flowing through the ESB, companies gain much greater visibility to what is happening in a business and can exert more control with SOA governance.

Identifying actionable business events

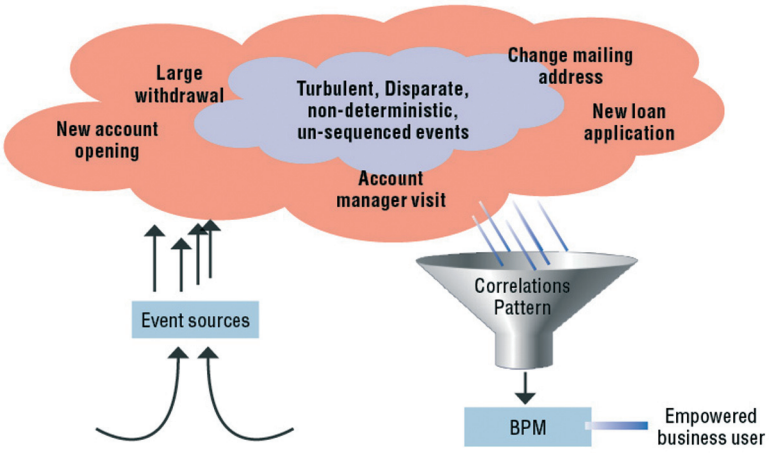
This combination of a better connected business with a visible and controllable flow of information between applications and services also provides additional opportunities for a business to gain even more benefits. The identification of business events as they take place can help businesses take immediate action. All manner of events take place in a business. Many of

these are simply steps in a business process that are entirely normal and would by themselves be of no interest. The business has already factored them in as part of the process, and IT processes those steps. However, depending on the circumstances and a combination of factors, some events might be of real interest to the business. Perhaps there might be an unusual purchase pattern for an item, or even a combination of items. There might be a number of incomplete business activities that are missing a final step. It might even be a combination of freezing temperatures and a delivery schedule. All these pieces of information conceivably could be flowing around a business and, as individual elements, might not be of any interest to business or IT.

Taking action on business events to increase business agility

With the myriad of events, actions and state changes taking place throughout the IT cycle, it is close to impossible for IT to decide which events are important enough to single out individually or in combination. However, when using SOA with an ESB, IT can make all the events taking place throughout the infrastructure visible. Business leaders need to define the events or combinations of events that they are interested in and then define the actions that should take place when such business events are monitored.

Without defining this prescriptive approach for handling events, potential business opportunities might be missed. Other consequences could involve unnecessary expenditure that could be avoided if circumstances were detected early enough.



WebSphere Business Events—Identifying the key business events as they occur, and taking action

WebSphere Business Events for detecting and responding to meaningful events

IBM WebSphere Business Events enables a business user to define the relationship between individual events and the action to take in response to detecting these events. Business gains when the company has a better idea of what is happening and can respond in a timely manner to complex events and situations. With WebSphere Business Events, companies can build and deploy actions and interactions that make changes to business processes and alter the flow of information and activities throughout the business without coding or changing existing applications. Business users and the IT infrastructure interact directly, using the tooling designed for a business person, creating a real connection between what the business wants and what IT will deliver.

Would a business be able to detect and respond to business events quickly and simply without a move to SOA? Given the complexity of the existing IT infrastructure, IT users would probably be the only resources able to make changes to detect and respond to events. It would be hard for IT staff to understand which events are the most important to the business, and every change would add complexity and increase the risk of failure.

The power of a product such as WebSphere Business Events comes not just from the sophisticated tooling for defining the events and actions, but also from the immediate visibility to what is happening through the access to the entire infrastructure. This is provided by the ESB acting as the transport and mediation layer throughout the enterprise so that there is not only SOA governance and control but also the detection of business events and the responses to those detected events. WebSphere Business Events can make use of the flow of events moving through the ESB and provide visibility of detected events and actions to process orchestration and business monitoring tools, such as WebSphere Process Server and WebSphere Business Monitor. The result is a better informed, more agile business that responds to changes and opportunities as they take place.

Client success stories using connectivity solutions from WebSphere

Already thousands of businesses have been working smarter and becoming more dynamic by moving to an SOA. They have been able to simplify their connections, improve the reliability of their IT infrastructure and address new business opportunities faster than before. With reliable SOA connectivity, businesses can connect to more assets and gain from new intelligence about

what is happening throughout their business. They can look beyond the individual issues of each line of business and start to build services and solutions that can be reused as part of a flexible connected SOA. Read examples of these successful clients at **ibm.com**/soa/success.

Your next step to a dynamic business

Don't be left behind as businesses around the world, both your partners and your competitors, become more dynamic, working smarter to meet the needs of the market and the customers. Ensure that your business is well placed and able to take the first step on your journey to being a dynamic business powered by SOA. Let IBM experts perform an SOA health check on your business.

Are you sure what is the best first project to attempt? Are you in good shape to start expanding beyond the initial SOA deployments and increasing reuse and agility? Let IBM help assess your SOA fitness and give you guidance on your next steps. Read more at **ibm.com**/soa/healthcheck.

For more information

You can also talk to your IBM representative to find out more about how a SMART SOA approach can help your business make the most of its existing assets and new opportunities, and learn more about the connectivity solutions available from IBM and WebSphere to reduce cost, complexity and increase business responsiveness. Read more at **ibm.com**/software/websphere/products/appintegration.

Additionally, IBM Global Financing can tailor financing solutions to your specific IT needs. For more information on great rates, flexible payment plans and loans, and asset buyback and disposal, visit: **ibm.com**/financing.

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