Enabling Real-Time Business Through A Service-Oriented and Event-Driven Architecture

Today businesses need to constantly adapt and reconfigure their IT assets, systems, and business operations to meet changing customer demands; compress business cycles; and differentiate from competition. Enterprises need to deliver accurate and relevant information when (and to where) it's needed to enable more predictable, higher quality business operations. To do this they need to sense, understand and respond to changes, threats and opportunities by harnessing the power of real-time events and services—what TIBCO Software Inc. calls The Power of Now® and real-time business.

However, most enterprises have invested in packaged, legacy, and custom applications that perform specific business functions. Unfortunately, these applications usually operate within an extremely complex, inflexible, and mostly ad hoc IT architecture consisting of monolithic silos, point-to-point connections and hard-coded interfaces. This makes it difficult to quickly assemble and reassemble the services they provide as part of business processes that support new and changing business requirements. This also makes it difficult to ensure that information about events and changing conditions is made available to the appropriate systems in order to proactively address potential issues.

Therefore, to enable real-time business, IT departments must architect their IT systems to do two things:

- Quickly and easily support new business requirements through the creative use and reuse of existing assets. This can be addressed by using a Service-Oriented Architecture (SOA)

- Automatically and immediately incorporate information about occurring events into business processes and decisions. This event and information delivery model is the cornerstone of an Event-Driven Architecture (EDA)

This paper is intended to help enterprise architects and IT decision-makers understand the importance, value and capabilities of SOA and EDA. This paper will explain why a combination of SOA and EDA is necessary to support the business requirements of today and tomorrow, and to describe how TIBCO is uniquely well-positioned to help companies implement a real-time enterprise architecture.

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1 Introduction

1.1 Service-Oriented Architecture

Enterprise IT is made up of applications and information sources that perform many functions and store countless pieces of information. These applications and information assets reside within different organizations and trust authorities, have been built using different technologies, and run in different execution environments.

Service-oriented architecture (SOA) is an architectural paradigm for creating and managing "business services" that can access these functions, assets, and pieces of information with a common interface regardless of the location or technical makeup of the function or piece of data. This interface must be agreed upon within the environment of systems that are expected to access or invoke that service.

SOA generally exhibits the following characteristics:

- **Loosely Coupled:** SOA enables independently developed service consumers and providers to interact regardless of technical makeup or location, and enable consumers to identify and discover services they are interested in with minimal level of common knowledge between the consumer and provider that is necessary for the exchange to take place.
- **Request/Reply:** SOA primarily supports interactions in which one specific system requests a piece of information or the execution of a function from one service provider, and the service provider subsequently sends a reply that provides the requested service.
- **Synchronous:** SOA primarily supports the synchronous invocation and execution of services. This means that when a consumer requests a piece of information or invokes a function, a connection between the two systems must be maintained until a response is received.

The primary value of SOA is that it enables the reuse of existing services and information, either standalone or as part of ***composite applications*** that perform more complex functions by orchestrating numerous services and pieces of information. For example, at a shipping and distribution company, a tracking number allows a retail customer to check on the status of the shipment. When coupled with other information, the tracking number allows retail customers to check on their shipment over the Internet, by phone, or by walking into a distribution and receiving center. The same tracking number can be used by the shipping and distribution company's business partners to offer tracking services to their own customers. Thus, a simple service is reused in different ways and combined with other services to perform a specific business function.

The ability to compose services that can be invoked on a stand-alone basis can dramatically reduce the cost and complexity of integrating incompatible applications, and the ability of developers across an enterprise to quickly create, reconfigure and repurpose composite applications enables IT departments to satisfy new and changing business requirements with existing assets in a timely manner.

However, an SOA infrastructure does not address all the capabilities needed in a real-time enterprise architecture. It does not have the ability to monitor, filter, analyze, correlate, and respond in real time to events. In addition, an SOA cannot handle long-running processes or the guaranteed delivery of information across disconnected systems. These limitations are addressed with an event-driven architecture, as described below.

1.2 Event-Driven Architecture

As the pace of business increases, companies are being forced to more quickly sense and respond to changes, threats and opportunities in the markets they serve, their supply chain and their internal operations. Each of these changes, threats and opportunities manifests itself as an event—a record of something that has happened. An event may be the placement of an order, a change in the price of some raw material, or the acknowledgement that an airplane will arrive 30 minutes later than expected. Events can be scheduled (e.g., a confirmation message will be sent every time an order leaves the warehouse) or unscheduled (e.g., bad weather forces an airplane to take a longer route around a storm and will therefore be late).

Consider the shipping and distribution company mentioned in Section 1.1. It cannot deliver a package if the address provided is incorrect. As a result, it needs to either contact the recipient to obtain the correct address, or request an address correction from an internal system that might be offline for routine maintenance. If the recipient's correct address cannot be located in a reasonable time frame, the package needs to be returned to the sender. Finally, information about the success or failure of this transaction needs to be transmitted to various departments for follow-up actions such as billing and reporting.

To address such needs, businesses require the ability to send, receive, and respond to unpredictable business information and events asynchronously. An event-driven architecture (EDA) provides that ability and, combined with SOA, creates a real-time enterprise architecture that enables real-time business.

An EDA is an architectural paradigm based on using events as triggers that initiate the immediate delivery of a message that informs numerous recipients about the event so they can take appropriate action. The message is delivered using a message bus taking into account the specific requirements of the situation in terms of importance, urgency and security.

EDA generally exhibits the following characteristics:

- **Asynchronous:** EDA primarily supports asynchronous interactions in which information is sent without the expectation of an immediate response or the requirement to maintain a live connection between the two systems while waiting for a response.
- **Publish/Subscribe:** EDA primarily supports many-to-many interactions in which systems publish information about an event to the network so that numerous other systems ,which have subscribed and authorized to receive such messages, can receive that information and act on it accordingly.
- **Decoupled:** EDA enables interactions between systems in which the publisher of a message does not know who the subscribers are and vice-versa – the interaction is entirely about the information being sent and received, not about a relationship between the two systems.

The primary value of EDA is that it allows companies to identify and respond to events that need to be addressed by one or more systems through events management. The events, collected via an EDA, can be analyzed and correlated to identify relevant patterns (or lack thereof), and then aggregated to build up information that is needed to solve the problems. With this process, companies can proactively address and respond to real-world scenarios in real time.

1.3 Importance of Web services and Web services standards in the evolution of SOA and EDA

Significant progress has been made in defining standards for how services are built, described and invoked. A Web service is the most commonly understood and accepted standards-based representation of a service. Web services standards use open XML and Internet-based protocols for the following:

- Service description (WSDL: Web Services Description Language)
- Service registration and discovery (UDDI: Universal Description, Discovery, and Integration)
- Service invocation (SOAP: Simple Object Access Protocol).

The increasing awareness and ubiquity of these standards is facilitating the adoption of Web services and implementation of standards-based SOA.

TIBCO is an active member of key standards bodies such as OASIS, W3C and WS-I, and is leading the effort to develop standards for both SOA and EDA. In particular, TIBCO is leveraging its expertise and experience as a pioneer of real-time and event-driven systems to help define a number of Web services standards for EDA as the co-author of key specifications, including:

- WS-ReliableMessaging
- WS-Eventing
- WS-Notification

In addition, TIBCO is actively involved with:

- Orchestration (WS-BPEL)
- Security (WS-Security)
- Monitoring and management (WS-DM) standards

2 Real-Time Enterprise Architecture

TIBCO believes that SOA and EDA must be delivered within a unified architectural framework to achieve true business agility and to future-proof the business. Many vendors are marketing SOA solutions without addressing the notion of asynchronous messaging and events, but organizations need to be able to send, receive, and respond to real-time business information and events. There are many benefits to SOA, but it does not support decoupled asynchronous message exchange and therefore cannot support the delivery of real-time business information and events, nor the subsequent analysis and processing of these events - a requirement for almost every company today.

One example that illustrates how a combination of events and services is necessary for a real-time enterprise architecture is as follows: A company's stock splits two for one. As a result, the depository trust company sends this corporate action to every subscribing firm. The firm must reliably transmit this event across all its front office, reconciliation, and back-office systems and it may need to be transmitted to partners and customers as well. Each system can then generate its own related events and perform services such as doubling the number of shares and halving the cost basis for the company's shares being traded and held across the firm. The services can then be shared across different departments/systems or may be unique to each department/system.

As illustrated in Figure 1 below, the deployment of SOA with EDA allows enterprises to scale the delivery of these services and information across multiple parties and systems. With EDA, enterprises also increase the degree of loose coupling between service providers and consumers, which means a higher degree of independence between service providers and consumers, making it easier to change and reconfigure a service while minimizing impact to other services that are dependent on that one service.

Real-time enterprise architecture combines SOA and EDA to deliver an agile architecture that is the foundation for real-time business. A real-time enterprise architecture enables companies to create flexible, re-configurable, standards-

based services as well as detect, monitor, filter, analyze, and correlate real-time events – both scheduled and unscheduled.

Let us look at another example that starts with an unscheduled business event and the effects of SOA and EDA have upon this event. Consider a simple business event such as the decreasing of profit margins in a regional location; this can trigger the invocation of a service that investigates the cause of the event. This service may be comprised of multiple services (e.g., Is there a stock-out at the local supplier? Has the cost of local labor gone up? Has demand for the product gone down?) Once this service provides a real-time response, action can be taken by composing services that are available to deal with the event appropriately (e.g., request parts from another supplier, go to an alternate or offshore manufacturing resource, or run a promotion to drive demand.)

This example again underscores the need for a real-time enterprise architecture that is both service-oriented and event-driven. Since standards for SOA and EDA are either still maturing or in the formative stages, companies must approach the development of a real-time enterprise architecture that leverages both architectures very carefully. To do so enterprise architects must acknowledge, understand and address the key functional requirements of both architectures.

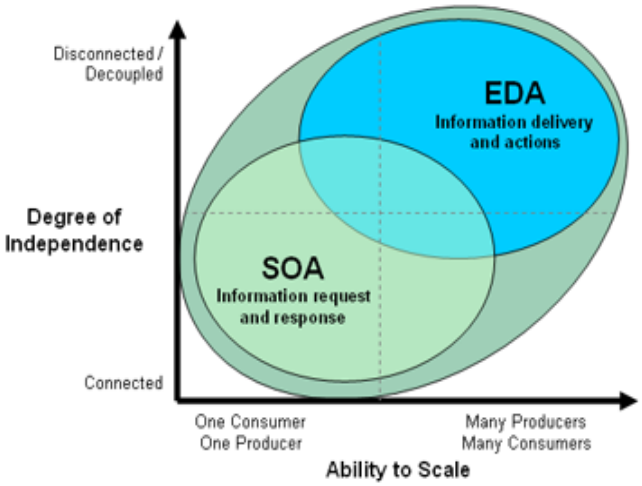

Figure 1: SOA and EDA on the Ability to Scale and Degree of Independence Axes

2.1 Functional Elements of SOA

As shown in Figure 2 below, there are three fundamental components of a basic SOA: Service Registration & Discovery, Service Description, and Service Request/Transport. Since effective and ubiquitous Web services standards are available for all three of these areas (UDDI, WSDL and SOAP respectively), Web services essentially provides a solid standards-based foundation for basic SOA.

A basic SOA, however, is not robust or reliable enough to address even the request/reply needs of large enterprises. Basic SOA does not provide facilities for ensuring consistency across the organization, high availability of services, security of non-public services and information, orchestration of multiple services as part of composite applications, or metadata management – all essential requirements for business-quality services.

In a basic SOA, the key requirement is to define how the system performs its workflow between services. This is more than just a service description – this involves creating a Service Level Agreement (SLA) between the services to define relationships, workflow, and policies to guide the operations of these components.

Building on the basic model described above, the key requirements for advanced SOA are:

- **Orchestration of Services:** Architects must give developers, and ultimately the business, the ability to orchestrate multiple services in order to rapidly create composite applications that address higher-order business requirements that are many times based on business processes.
- **Metadata Management:** Architects must put in place a system which supports the intelligent management of attributes and characteristics – referred to as *metadata,* which is *data about data*, including metadata of services and composite applications. This system must give developers from different parts of the organization the ability to invoke and adapt services without impacting the work of other developers and the operation of other services and composite applications.
- **Monitoring and Management:** Architects must ensure that administrators have the ability to monitor the availability and performance of individual services and composite applications built across a distributed network of services. Administrators must also have the ability to remotely manage and deploy the network of services and any new services as they become available.
- **Security:** Architects must ensure that developers can easily secure services by performing such functions as access control, authentication, and authorization of requests and encrypting sensitive information based on access levels. There must also be optional provisions for perimeter defense or appropriate levels of security when dealing with inter-departmental, partner, or customer requests.
- **Reliability, Availability, Scalability:** Architects must ensure that the architecture supports the reliability and availability of individual services and composite applications, and that it can accommodate rapid and unexpected increases in transaction volume through the automatic instantiation of new and increasing numbers of services.

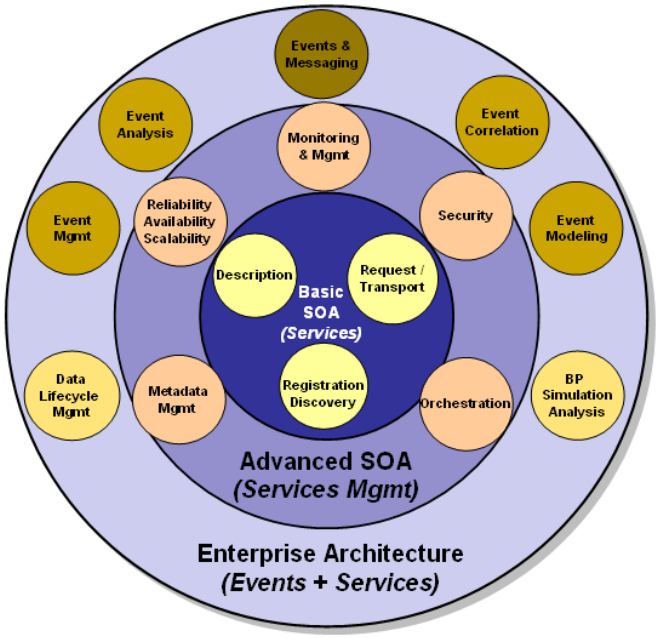

Figure 2: Functional Elements of Real-Time Enterprise Architecture

2.2 Functional Elements of EDA

Technology required to support events and messaging must enable event management, event analysis, event correlation, and event modeling. In addition, it must support data lifecycle management, business process and simulation analysis.

- **Asynchronous Messaging:** Architects must ensure that applications have at their disposal a system for sending asynchronous messages when those events occur. Since asynchronous messaging does not require an immediate response from the recipient and ensures delivery of the message, this allows for reliable generation and consumption of events that will be acted upon by the appropriate entities even if the system is temporarily unavailable.
- **Event Management:** Architects must ensure that a system is in place for identifying and aggregating events so that events are managed in much the same way that enterprise data and business processes are managed. This includes the ability to look at events as they occur and as they have transpired in the past, and be able to look at sets of events that together can be used to address a specific business scenario. An example of this is a set of RFID events that a manufacturing company receives at their receiving bay. Taken together these events would then dictate if the manufacturer has the required parts to build their product and take appropriate action if they haven't received all the components.

2.3 Benefits of Real-Time Enterprise Architecture

Only by providing every one of the above-mentioned functional elements can an enterprise architecture support the current and future needs of a large enterprise. TIBCO's real-time enterprise architecture addresses the technical capabilities required and effectively converges SOA and EDA. Addressing all of these requirements is not easy, but the value of implementing a real-time enterprise architecture is significant. An enterprise can:

- **Improve ability to support new and changing business objectives:** By providing the ability to incorporate both services and events into business services and composite applications, real-time enterprise architecture enables the rapid development and deployment of new services that meet business requirements and that can handle real-world inconsistency and exceptions. This enables companies to provision services dynamically as business needs fluctuate – and before unexpected events impact the bottom line.
- **Expand and extend the value of existing applications:** Real-time enterprise architecture unlocks the full value of existing applications by making their functions more easily accessible to a broader audience of potential consumers, and by enabling them to proactively notify the rest of the system when an event occurs within their domain.
- **Reduce the cost and risk of deploying new business services**: Real-time enterprise architecture makes it easier, less time-consuming and less risky to develop and deploy new services by enabling developers to assemble composite applications out of existing modular services and events. Building services from a common set of services and events also ensures that services built by different developers will perform core functions in a similar manner, and that changes to those core functions will always be immediately incorporated into activities across the organization.

3 How TIBCO Delivers Real-time Enterprise Architecture

With thousands of customers, TIBCO has a long track record of helping customers leverage their current and future IT investment through enterprise architectures to derive greater value out of their business. Only TIBCO has a proven and complete product offering to support SOA and EDA, and TIBCO is a driving force behind the development of standards that support SOA and EDA.

Customers have been using TIBCO's infrastructure to provide service-oriented and event-driven capabilities in production for many years. Some of TIBCO's customers have built a flexible enterprise architecture that allows a request for development and roll-out of a business service to be managed by answering the following questions:

1. What services would the new business service use? What are the exception conditions?
2. What events trigger this service? And what services trigger this event?
3. What other services does this impact? What other events are relevant to this service?
4. What is the cost for developing this new service?
5. What is the expected completion date for roll-out of this service?

These customers are able to answer these questions easily, thereby giving valuable operational visibility and flexibility to the enterprise – the Holy Grail for a service-oriented and event-driven architecture. TIBCO helps companies answer these questions by providing software with the following capabilities.

3.1 Support for Distribution and Processing of Event-Driven Information

TIBCO provides comprehensive support for asynchronous events and messaging in the form of messaging software that has proven itself in thousands of customer environments around the world. For most customers, TIBCO Enterprise Message Service™ provides the ideal backbone for asynchronous message exchange because it is based on standards such as XML and JMS; it supports integration with other languages and platforms such as C## and .Net; and also serves as a standards-based front end to other TIBCO messaging products such as TIBCO Rendezvous® and TIBCO SmartSockets™. TIBCO Enterprise Message Service has been adopted in industries such as financial services that require reliable, standards-based, scalable and high-performance solutions that increase operational efficiencies, enhance customer service, and quickly adapt to changing business conditions. TIBCO is also driving the Web services standards in the messaging and event-driven space and is a co-author of the key standards for:

- Reliable Messaging (WS-ReliableMessaging)
- Notifications (WS-BrokeredNotification, WS-Topics)
- Eventing (WS-Eventing)

TIBCO is also driving the consolidation of WS-Eventing and WS-BaseNotifications.

3.2 Orchestration of Distributed Enterprise Assets

The orchestration of services and events across applications, geographical locations, organizations and technological boundaries is TIBCO's core business. Service orchestration enables organizations to align their IT resources and assets with the business needs and ultimately the appropriate business process.

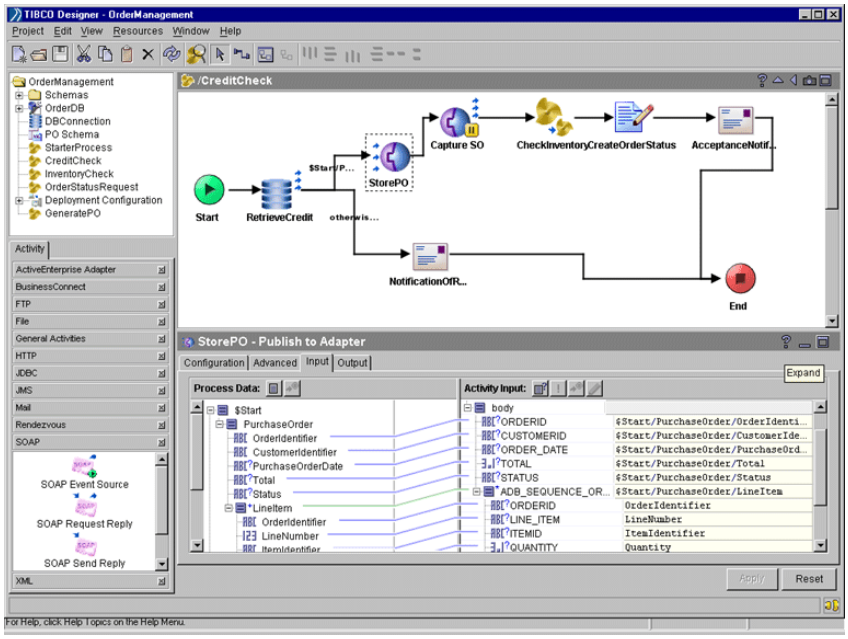

Figure 3: Graphical User Interface from TIBCO® BusinessWorks

TIBCO® BusinessWorks, a completely standards-based integration platform, provides the capabilities to orchestrate services across the enterprise. TIBCO BusinessWorks provides a graphical user interface that can be used to model and orchestrate business processes, establish connections between applications, services, and process definitions; and a process automation engine that sends instructions and information to applications so they can perform the tasks required of them in the proper sequence. TIBCO BusinessWorks supports the management of long-lived services and processes with complete support for exception handling and resolution. TIBCO BusinessWorks also provides a Web-based interface with which people can monitor and manage the execution of automated activities.

TIBCO® Staffware Process Suite is an industry leading business process management solution that can capitalize on the integration infrastructure put in place with TIBCO BusinessWorks and a real-time enterprise architecture. TIBCO Staffware Process Suite enables the orchestration of business processes, which can involve both service and human. It also provides value added services such as predicting the time-to-completion of business processes which also plays a key role in business process simulation and business event modeling.

TIBCO is a key proponent of standards in the business process modeling and orchestration space with membership in WS-BPEL and support for the Web services standards in TIBCO BusinessWorks and TIBCO Staffware Process Suite.

3.3 Enterprise-Scale Management of Metadata

Because every application and service has its own way of describing itself and the functions it performs, accurately cataloging the characteristics of individual services and the relationships between them can be a daunting task. Many businesses have adopted XML as the standard to represent their corporate data assets, but the use of XML on its own does not support the level of organization, consistency and control that is required to implement a model-driven semantic infrastructure that drives service and event definitions.

TIBCO addresses this requirement with a software product called TIBCO XML Canon™. TIBCO XML Canon uses a canonical data model to map each piece of metadata against a central repository. Any application can use or reuse that

metadata without worrying about how it will affect other applications. Users can access and use the same meta-tagged information in multiple systems, which reduces the costs and errors affiliated with inconsistency and duplication of data across multiple systems. With a capability called Smart Impact Analysis, TIBCO XML Canon automatically flags how changes in one place will affect metadata used elsewhere, thereby helping users detect the impact of changes on the system without coding and debugging.

TIBCO XML Canon also provides the lifecycle management capabilities for Web services metadata and assets, such as WSDL, and XML schema documents, along with process models and definitions. It provides versioning capabilities for services and a repository for managing different versions of process and services models and metadata. These capabilities are already embedded into TIBCO BusinessWorks but can also be used independently to manage Web services and XML assets. TIBCO is also driving the inclusion of sophisticated metadata exchange formats as part of the next evolution of the WSDL specification and is also involved in evolution of the WS-MetaDataExchange specification.

3.4 Management and Monitoring of Distributed IT Infrastructure

Ensuring the consistent and continuous performance of services, events, and business processes requires a sophisticated solution for monitoring and managing large numbers of disparate assets that are distributed across the enterprise. This is a critical component of IT governance of systems, services, and applications. Not only must the applications services themselves be monitored, but also their entire supporting infrastructure and external resources (databases, systems, networks, etc.) must be accounted for. The impact of external resource failures and degradations must be mapped back to the appropriate business service to maintain uptime.

Via the TIBCO Hawk™ application monitoring and management framework, TIBCO keeps IT infrastructure running at peak efficiency at all times by enabling the remote monitoring and management of distributed applications and information sources, and by enabling the automated resolution of predefined conditions and events. Disparate application objects can be easily normalized for monitoring and management, allowing true cross-architecture composite service management. TIBCO offers more than just basic monitoring of asset performance and network traffic. With TIBCO OpsFactor™ and TIBCO® BusinessFactor, TIBCO provides business-level and process-level monitoring that are used to determine whether an organization is realizing desired benefits from a particular service or composite application. For example, a bank may want to monitor whether or not it is performing credit checks within a desired time.

TIBCO was a key contributor on HP's Web Services Management Framework (WSMF) specification that has now become the basis for the OASIS WS-Distributed Management (WSDM) standard. TIBCO Enterprise Management Advisor™ is based on WSDM and WSMF and has the ability to communicate bi-directionally with various enterprise systems management platforms, like HP OpenView, using Web services. TIBCO also provides capabilities to manage the Web services infrastructure and Web services from both TIBCO and non-TIBCO environments. These capabilities augment TIBCO Hawk, the workhorse for event and messaging monitoring and management for TIBCO applications, and provide an end-to end monitoring and management solution for composite applications.

3.5 Superior Reliability, Availability, Scalability (RAS)

TIBCO's name has become synonymous with the guaranteed, reliable and scalable delivery of information, events, and services. TIBCO's technology has been deployed across some of the world's largest companies where it is the enterprise architecture delivering some of the most demanding computing environments for many years. TIBCO's software is recognized as one of the most trustworthy and scalable software in the field. Every day billions of dollars are traded and managed using TIBCO's technology – where business continuity and reliability are critical to the enterprise.

3.6 Security

Security is another critical aspect of IT governance. The requirement to enable access to distributed services for authorized consumers is the foundation of governance using a service-oriented approach, and it introduces the need for sophisticated security capabilities. As such, enterprises need to provide appropriate access, authentication, and authorization to the network of services and the underlying IT assets. This need becomes even more acute as the network of services grows in number and also encompasses consumers from other domains such as other departments within the enterprise, employees, partners, and customers. TIBCO provides a secure and reliable infrastructure across its entire set of product offerings. TIBCO is also very active in the Web services security standards (WS-Security) and is a charter and voting member of the WS-Security Technical Committee.

4 Examples of Real-Time Enterprise Architecture

As the following case studies illustrate, TIBCO has a track record of helping customers successfully implement a real-time enterprise architecture that leverages the synergy of SOA and EDA to solve real business problems.

4.1 Case Study: DBS

DBS is one of the largest financial services groups in Asia. It has dominant positions in consumer banking, treasury and markets, securities brokerage, equity, and debt fund raising across corporate, institutional and retail markets in Singapore, Hong Kong, Thailand, Philippines, Indonesia and China.

As DBS started to grow, it saw the need to build a technology platform that promotes business agility. Systems that are connected by custom point-to-point interfaces that are not reusable meant that the company had to spend significant resources in developing and maintaining the infrastructure. Instead of fixing the problem in piecemeal fashion DBS decided to rebuild its technology foundation using a SOA.

Working with TIBCO, DBS implemented an architecture that helps standardize back-office services through a service-oriented approach. To date, the DBS team has implemented some front-end applications—such as the corporate Internet banking application supported by TIBCO-based integration services. The DBS integration team has encapsulated more than 20 host applications with TIBCO software. However, at the top of the team's agenda is a plan to build services that wrap the bank's major applications. These reusable services will enable DBS to quickly and cost effectively reproduce distinct versions of its customer-facing applications—for use in different countries—from a shared library of back-office services. By providing a predictable, standard way to perform integration and create services, TIBCO helps to reduce the time and resources needed to integrate new services and systems into DBS' standard platform. This will make it easier for DBS to deliver superior and consistent customer services in every new market they enter.

The solution has helped DBS improve time-to-market for DBS products and given the company the agility it needs to react to changing market conditions – all under achievable budget. The bank has realized an unanticipated 50 percent cost savings in file transfer management. The maintenance and support costs for integration components also were cut in half. By using the infrastructure that was built upon SOA, another project was able to cut development costs by 20 percent.

4.2 Case Study: Lufthansa Cargo AG

Lufthansa Cargo AG (LCAG) is the freight subsidiary of Deutsche Lufthansa AG, the German national airline. Although its core business is the processing of airport-to-airport airfreight, the company offers several services using a global network of routes to 495 destinations.

In order to be competitive, Lufthansa relies on process optimization. This meant that the company needed to have an infrastructure that dovetails process with IT management, and that IT management has a direct influence over the quality, flexibility, operational efficiency, and costs of business processes. To adapt its strategic IT infrastructure to new trading conditions, Lufthansa launched a project to replace its existing multi-functional system with a more modern IT infrastructure that is more flexible and will improve the data consistency, security, and documentation of its software applications.

The new infrastructure will take on a service-oriented approach in order to integrate other applications. The architecture will replace the current complex spaghetti structure and will be easier and more cost-effective to maintain. It consists of an Information Bus™ as the backbone, together with the applications, Web services, and interfaces connected to it. These elements form an efficient architecture for running business processes in real time. In the future, Lufthansa plans to implement Web services with this infrastructure to connect customers' and partners' systems.

With the new architecture, Lufthansa has realized a faster time-to-market for new products and services. The company has successfully integrated several applications to the architecture and more are being planned for the next two to three years. The solution allows the company to reduce operating costs by cutting the time and effort in the implementation and maintenance of the infrastructure, as well as costs and risks associated with future development.

5 Summary

Services and events are both important elements of enterprise computing, and therefore SOA and EDA are essentially parts of how companies develop, deploying, and managing distributed applications. TIBCO provides a complete infrastructure platform that meets all of the functional requirements for SOA and EDA and is already delivering value to customers around the world in production deployments.