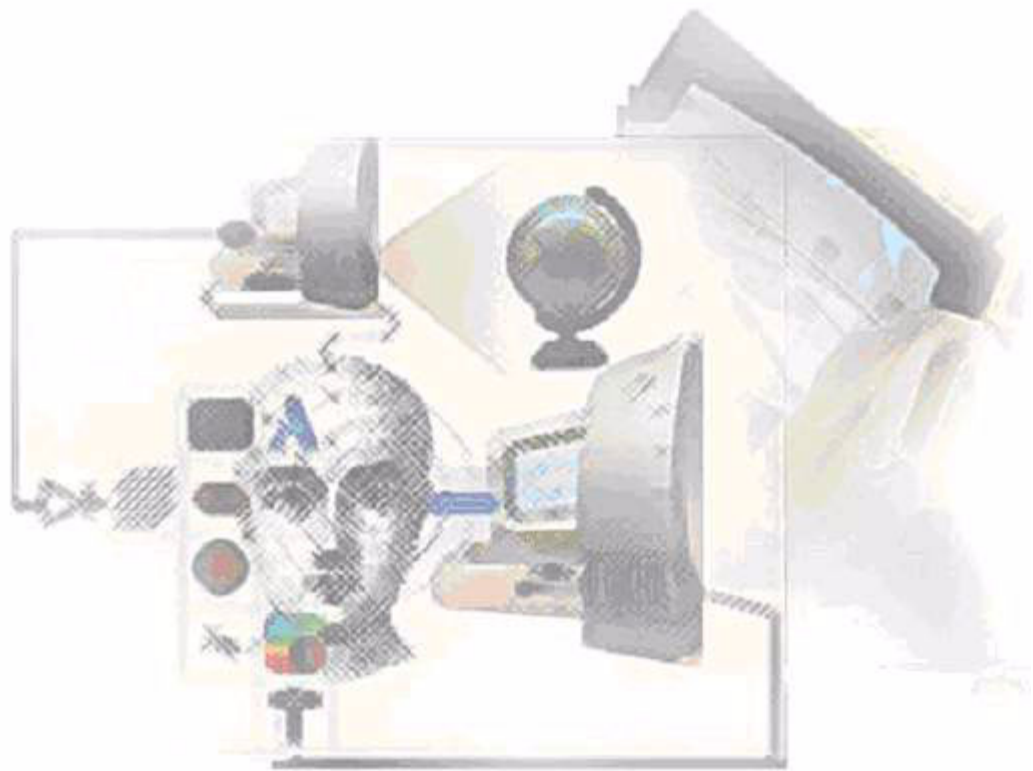# Service Oriented Architecture Implementation Frameworks

Understanding the business benefits of Services Oriented Architecture Implementation Framework (SOAIF)

Fiorano
Enabling change at the speed of thought

▶ Introduction

Today's environment is rapidly changing. Business dynamics and technological innovations have left organizations with a disparate mix of operating systems, applications and databases. This makes it difficult, time-consuming and costly for IT departments to deliver new applications that integrate heterogeneous technologies.

Enterprises have traditionally implemented separate solutions for operating legacy and packaged applications, business-to-business (B2B) interactions, collaboration and general-purpose distributed computing. Moreover, IT professionals also need to plan for unforeseen and changing dynamics created by mergers and acquisitions, new partnerships, expansion, and new customer requirements. This creates a serious bottleneck in the ability to manage, change, and modify enterprise processes to dynamically match changes in requirements.

The key to success in the networked economy is the ability to create and modify processes to automate value chains in concert with changing requirements. Faster change management will help enterprises integrate their processes over the Internet so can achieve greater efficiency, generate more revenue, and enter new markets.

A new category of enterprise infrastructure solutions, built on a service-oriented architecture (SOA), will deliver these benefits. SOAs are based on the notion of services, which are high-level software components that include Web services. Implementation of an SOA requires tools as well as run-time infrastructure software, which we collectively refer to as an SOA implementation framework (SOAIF). An SOAIF includes both design-time and run-time capabilities as well as all the software functionality an enterprise requires to build and operate an SOA, including service-oriented:

- Tools

- Management

- Integration

- Processes.

Users compose processes by connecting multiple service instances using visual tools, while the SOAIF provides the run-time deployment infrastructure across the network for running the application and process. An SOAIF lets business analysts create, deploy, manage, and change processes spanning multiple enterprise applications, departments, and partners.

SOAIFs address the needs of process management at the application, human-interaction, and implementation levels. The SOAIF addresses these needs within and across enterprises and across multiple domains, including EAI, B2B integration, business process management (BPM), collaboration, and even network management each area is traditionally served by distinct solutions.

▶ Benefits of an SOAIF

An SOAIF focuses on internal and cross-enterprise processes, helping organizations streamline operations, reduce costs, and increase responsiveness. Specifically, an SOAIF provides general-purpose, service-based distributed computing capabilities that deliver:

- Faster response rate to changing business requirements

- Operational efficiencies

- Faster, less expensive application integration

- Easier application development and deployment.

Responsiveness

Existing enterprise solutions are inadequate in their ability to quickly change processes in response to changing business dynamics. The effort typically requires additional manual code development and results in a system that's difficult to maintain and extend. An SOAIF strengthens the enterprise by enabling rapid changes to existing processes by dynamically allowing the inclusion of additional services or modification of existing services. An SOAIF also includes support for run-time deployment, allowing modified processes to be redeployed instantly.

Efficiency

Most packaged enterprise applications perform well in streamlining processes related to standard tasks. However, the performance rapidly deteriorates while automating and streamlining customized processes that encompass multiple enterprise applications. The process is difficult, time-consuming, and expensive to implement and maintain.

The SOAIF infrastructure addresses this issue by allowing the definition of any process in any network topology, spanning multiple enterprise boundaries. This is accomplished via peer-to-peer messaging infrastructure with distributed security mechanisms that allow efficient data exchanges for easy implementation, while enabling each enterprise to enforce its own security policies. This allows an SOAIF to increase operational efficiency across the entire value chain.

Application Integration

Existing packaged application integration solutions are complex and require significant implementation effort, often including extensive manual coding for deployment purposes. An SOAIF provides native support for run-time deployment of services across the network and dramatically reduces the overall costs of application integration and deployment by automating these time-consuming processes. It also allows extension of integration across business boundaries.

Application Development & Deployment

In the traditional software development process, translating requirements into working distributed systems is both time-consuming and difficult, requiring several stages of manual development and deployment. This complex, error-prone task can be effectively streamlined using a higher-level, component-based SOAIF. The SOAIF incorporates tools that let processes that are developed, using standards such as Business Process Execution Language (BPEL) to be easily translated into distributed high-level services, which are easier to develop, manipulate, and debug. These services are easily composed into implementation-level data flows without the user or developer having to track complex middleware concepts, such as topics or queues. Further, the implementation-level services can run on any machine across the network by virtue of the built-in dynamic deployment support SOAIF provides. The combination of service-oriented tools and built-in support for distributed debugging, run-time tracing and logging, and dynamic deployment allows the SOAIF to dramatically reduce the time taken to implement and deliver working processes.

▶ SOAIF Requirements

An SOAIF is a general-purpose infrastructure platform that lets developers and business analysts create, deploy, manage, and change processes within and across the enterprise. SOAIFs have unique requirements at both the tools and infrastructure levels that are not typically provided by any single current technology or platform. These include:

Distributed, event-enabled architecture

- Flexibility via service-enabled processes

- Enterprise standards support

- Fault tolerance, reliability, and scalability

- Security in distributed environment

- Visual process composition and monitoring

- On-the-fly process changes.

By addressing these requirements, an SOAIF lets users quickly respond to changes and integrate operations efficiently, regardless of platform, language, database, or application.

Distributed Event-Enabled Architecture

Enterprise processes are usually distributed across multiple applications and hardware/software systems. These processes are also event-based in the sense that the sub processes are linked by a series of events. For example, the depletion of inventory at a manufacturer may lead to an event-trigger that's automatically generated and propagated to one or more suppliers to replenish the depleted inventory items.

Most current BPM solutions control the processes through a centralized hub. Changes to applications, or additions of new applications, require modifications at the centralized hub. Further, all data exchanged between applications needs to traverse the central hub. This type of topology restriction is inefficient, inflexible, and leads to bottlenecks. To overcome this limitation, a framework that tries to integrate enterprise processes needs to be fully distributed across the network within the enterprise. The framework must also be symmetric, which implies that the same event-based infrastructure software and tools need to run on all machines within the enterprise.

Flexibility via Service-Enabled Processes

An SOAIF should make it simple to deploy, manage, and change participating processes. This implies a service-based architecture, in which applications are composed of "coarse-grained" enterprise services (including Web services) loosely bound to each other via event-based messaging, with each service potentially running in a separate process. Such an architecture enables a rapid deployment model, decreasing the lead times required for solution implementation. This architecture should support on-the-fly modification of processes, letting analysts change and instantly redeploy processes to meet rapidly changing requirements.

Enterprise Standards Support

Support for data exchange, messaging, and existing enterprise standards becomes essential in an SOAIF. Since content needs to be exchanged between partners, XML messages and documents will be the desired format. Further, since most businesses want to leverage existing infrastructures, an SOAIF needs to easily support multiple standards.

Fault Tolerance, Reliability, & Scalability

An SOAIF should be able to offer an extremely high degree of reliability. The platform should support a broad range of processes that span an increasing number of applications, corporations, and partners. To eliminate single points of failure and to maximize performance, a fully distributed architecture becomes essential.

Security in a Distributed Environment

An SOAIF needs to be fully distributed for maximum performance and scalability. In such a distributed computing environment, it becomes necessary to restrict the scope of interactions that partners can conduct with the corporate IT infrastructure. It becomes necessary to allow customization for the interactions of each partner by providing different security roles on a per-user and per-service basis. This requires a security model that incorporates users, Web services and more general enterprise services and that's fully distributed and fault-tolerant, such as the SOAIF infrastructure itself. This security model needs to be based on existing standards and tools and should support certificate authentication at both the user and services level.

Visual Process Composition

An SOAIF needs to provide a single dashboard with visibility into an organization's entire distributed computing environment. The platform should incorporate visual implementation-process-composition tools, together with infrastructure-level support to instantly deploy the modeled implementation-level processes across a distributed enterprise network. The visual composition tools need to be service oriented in the sense of being able to directly manipulate higher-level, coarse-grained implementation processes as first-class objects. They also should provide both a visual display of programming constructs and be able to map directly (and naturally) to deployable processes.

A critical problem in deploying distributed systems is monitoring and debugging concurrently running processes. An SOAIF should provide native support for tracing, logging, and monitoring any process or service across the distributed environment.

Process Changes

Another challenge is responding to changing requirements. An SOAIF should provide support for incremental on-the-fly modification of the service-based flows that implement processes. This is among the most critical features expected from an SOAIF since it lets analysts visually change and instantly redeploy processes to address dynamic requirements. Such changes are implemented within an SOAIF by abstracting all concepts relating to lower-level middleware at the tools and applications levels.

Users simply specify that a service be replaced by another running service (often on another machine); the SOAIF dynamically reroutes data to the new service by setting up new underlying middleware constructs (such as topics and queues, for example) on-the-fly. This allows the implementation to be changed without stopping the current process in much the same way as hardware is upgraded on a mainframe system without interruption of operations.

▶ SOAIF Components

Essential elements of an SOAIF include design-time and run-time infrastructure, together with service-oriented tools for deploying distributed processes and implementation flows. The core infrastructure of an SOAIF is typically provided by an enterprise service bus (ESB), which addresses the challenges in composing, deploying, and managing distributed, service-based enterprise applications. The ESB incorporates a standards-based, enterprise-class messaging backbone, together with enhanced systems connectivity using Web services, Java 2 Enterprise Edition (J2EE), Microsoft .NET, and other standards.

An ESB links individual enterprises together for extended process efficiency across the supply chain, allowing them to become more flexible and adaptable to rapidly changing requirements. The ESB lets an enterprise leverage its previous investments by supporting the deployment of processes over existing software and hardware infrastructure. As the core, underlying infrastructure of an SOAIF, ESBs offer several unique business and technical advantages:

- Support for enterprise standards

- Fault tolerance, scalability, reliability

- Service-based tools

- Easy process deployment and changes

- Component-level security

- Run-time monitoring, tracing, and logging.

Enterprise Standards Support

ESBs implement standardized interfaces for communication, connectivity, transformation, security, and portability. Supported standards include:

- JMS for communication

- Web services, J2EE, and .NET for connectivity to various systems

- Extensible Stylesheet Language Transformation (XSLT) and Xquery for transformation

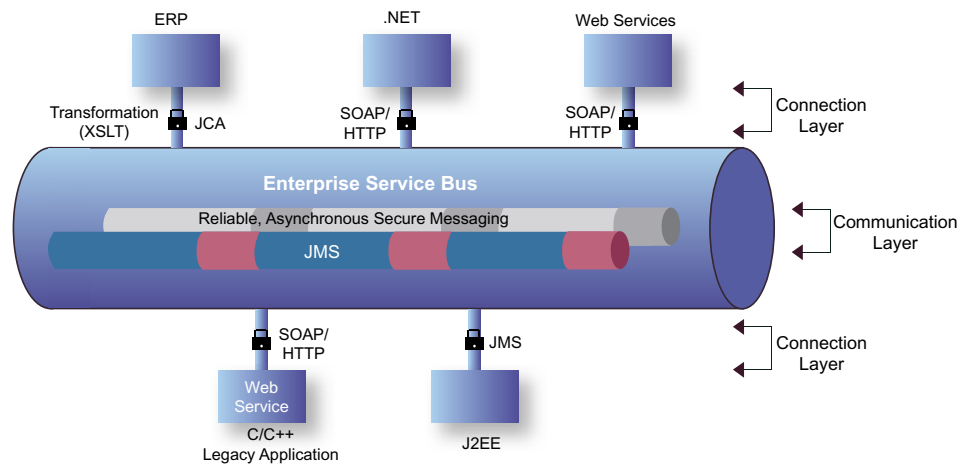- Lightweight directory access protocol (LDAP), secure sockets layer (SSL), and others for security.

Figure 1 ESB Architecture

Modern ESB implementations (see Figure 1) typically support development in multiple languages. This, combined with the inherently portable ESB infrastructure, makes the ESB a true multi-language, multi-platform enterprise backbone and an ideal foundation for an SOAIF.

Fault Tolerance, Scalability, & Reliability

Several modern ESBs implement a symmetric, distributed architecture in which peer-messaging servers run on multiple nodes of an enterprise network, providing a highly scalable, reliable distributed messaging platform with no single point of failure. Modern ESB architectures combine the benefits of

centralized control with distributed, parallel data flow, giving application developers the ultimate flexibility in defining the network topology of choice to route data directly and optimally between services.

Ensuring that data flowing between services does not always have to traverse a central point in the network optimizes peer-to-peer network performance. For instance, if one has a process that requires data exchanges between New York and Boston, as well as between San Francisco and Los Angeles, then the two flows of data don't necessarily have to traverse a messaging hub located in Chicago (which is often the case in most enterprise or cross-enterprise deployments). Instead, efficiency dictates setting up direct data flow connections between peer nodes on a network.

Service-Based Tools

Service-oriented tools enable composition of distributed applications from one or more services (Web services and more general enterprise services), each of which typically runs in a separate process. Services may be written in any language and communicate with each other via XML messages. This allows service-oriented tools within an SOAIF to compose flexible, easy-to-modify systems.

Easy Process Deployment & Changes

Service-oriented processes deployed in an SOAIF are composed of "coarse-grained' Web services ideally suited for easy change and replacement. By abstracting the details of message routing from service implementations, service-oriented tools decouple and enable running processes to be modified on-the-fly by simple service replacement or addition. The tools framework within an SOAIF supports the run-time deployment of services, allowing changed processes to be deployed instantly across the network. Our experience is that this significantly reduces solution deployment costs compared with traditional, broker-based solutions.

Component-Level Security

The ESB defines a comprehensive security system, giving administrators full control over which services are executed where. ESBs provide the ability to set several security attributes for each service and provide administrative tools to configure security settings on the distributed ESB infrastructure across the network.

Run-Time Monitoring, Tracing, & Logging

ESBs include native service-level support for run-time monitoring, tracing, and logging. All services can be monitored instantly using visual tools within the SOAIF. Trace levels can be dynamically changed within existing services running across the network and debug logs can be routed to software tools on any node. These features greatly simplify the development, deployment, and debugging of distributed applications running across the SOAIF.

▶ Conclusions

The move toward SOAs will affect all distributed computing in the future. SOAs provide a layer of abstraction over all existing architectures, allowing distributed solutions to be built by composing asynchronous services into composite applications over a network.

Deploying an SOA requires software that provides service-oriented management, integration, security, tools, and processes. While these segments are currently served by individual packages and solutions, they'll evolve into a single SOAIF.

SOAIFs include all the distributed computing functionality an organization needs to develop, deploy, manage, and extend an SOA; these frameworks will come to dominate enterprise computing over the next few years.

▶ About Fiorano Software Inc.

Based in Silicon Valley, California, Fiorano is a leading provider of Enterprise class business process integration and messaging infrastructure technology. Companies use Fiorano products to develop Real-Time Enterprise competencies, improving operational efficiencies and business performance by easily deploying flexible business processes spanning multiple applications, platforms and partners. The Fiorano ESB™ is a standards-based integrated composite application platform for real-time business, enabling the effective coordination and interaction of software assets across the extended enterprise. Fiorano solutions power Enterprise Nervous Systems of Fortune 500 companies like AT&T, Alcatel, American Express, Motorola, POSCO, Boeing, Toyota and Lockheed Martin. Fiorano's customers spread across fast-growing sectors such as, telecommunications, health, technology, financial services, government, manufacturing, retail and transportation. For more information visit www.fiorano.com or e-mail sales@fiorano.com.