Service-Oriented Architecture and PeopleSoft Enterprise Applications

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EXECUTIVE SUMMARY

Through a combination of Oracle Fusion Middleware and Oracle’s PeopleSoft Enterprise applications, Oracle offers a complete service-oriented architecture, which you can use as a foundation for adaptive business processes. The design of PeopleSoft Enterprise lets it operate in a service-oriented architecture without you having to rewrite the applications or perform a major upgrade.

This white paper demonstrates why you should consider implementing a service-oriented architecture (SOA) and how Oracle provides the best SOA through a combination of PeopleSoft Enterprise and Oracle Fusion Middleware. It also shows how PeopleSoft Enterprise enables services today and highlights why its underlying application architecture provides a solid foundation for services. Finally, it reveals how Oracle Fusion Middleware works in conjunction with PeopleSoft Enterprise to provide a foundation for adaptive business processes.

FRAGMENTED INFORMATION TECHNOLOGY LANDSCAPE

Today’s chief information officers face a unique challenge: a fragmented IT infrastructure. Over the last 25 years, IT organizations implemented systems to address point solutions, such as manufacturing resource planning (MRP). These systems multiplied and went from just a couple per company to dozens, if not hundreds. This left CIOs with a complex and diverse software portfolio—and with the question of how to make many disparate systems act as one and how to tackle changing business requirements.

Enterprise application integration (EAI) and other middleware solutions certainly address this issue by enabling systems to communicate with each other, but they don’t solve the problem entirely. Their ability to create cross-application business processes is inadequate, and they allow only limited business process adaptability.

The problems they do solve come at a high cost. The majority of EAI and middleware solutions use proprietary technology, which locks you into a single vendor. In addition, the systems become tightly coupled, so if an interface change occurs in one system, all other systems need to be adjusted. This raises the cost of...

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* Oracle Survey to Customer Base
change, and in an operating environment in which IT is being asked to do more with less, this increase in the cost of change means that you can’t run the business cost-effectively.

**Solution: Service-Oriented Architecture**

For those customers, a service-oriented architecture helps address the fragmented IT landscape. For now, don’t worry about the technical aspects of an SOA, which this paper covers later. At the business level, an SOA enables the fragmented aspects of business functionality isolated in various systems to be leveraged within a business process, facilitating easy creation or modification of the process, and thus enabling CIOs to make their diverse, complex software portfolio act as a single unit to better serve the business.

**WHAT IS A SERVICE-ORIENTED ARCHITECTURE?**

A service-oriented architecture provides a standards-based platform that allows services to be provided, discovered, and consumed by each other, in order to facilitate the creation of a business process. This definition begs the question: What exactly is a service? A service is a unit of discrete business functionality. The most commonly used example of a service is a stock quote—the service takes a stock symbol as an input and delivers the current price of the stock.

In a business context, a good example is an order-status service. It is common for customers to want to use multiple methods to see the status of an order. An order-status service could take an input describing the order, such as the order number, and return the status of the order via telephone, a call center, or the Web.

Services are realized with the advent of Web services. Although the concept of services has existed for decades in the software development arena, Web services take the concept to the next level of practicality, by using standard internet protocols to provide the foundation for interoperability. With vendors ubiquitously adopting Web services and standards appearing to address almost any requirement, Web services provide a natural foundation for the next-generation enterprise architecture: Service-Oriented Architecture (SOA).

**Service-Oriented Architecture Lifecycle**

A SOA offers little value just in being a SOA, it is what you do with a SOA that offers real tangible business value. The best way to look at what you do with a SOA is in terms of a SOA lifecycle. What steps must you take to be effective?

- **Exposing Services.** At the core, a SOA is about services and thus, you must be able to expose services. This means offering business logic contained in an application or other system as a service, whether that is a Web service or a native java call, services must be exposed.
- **Finding Services.** In today’s modern IT environment, it is not sufficient to just expose services, developers must also be able to find them. The
typical SOA developer is not familiar with the application or the functionality offered by a Web service. They must have a repository in order to store information about the Web service.

- **Utilizing Services.** Having and being able to find services is insufficient for a Service-Oriented Architecture – you must be able to do something with them whether that is leveraging them to create a business process, synchronize data or just modify a service.

- **Managing Services.** Managing services surrounds everything else other than exposing, finding and utilizing services. This part of the lifecycle includes deploying, managing and securing Web services. It’s a key part to move SOA from an abstract concept to something that actually offers business value.

Beyond the lifecycle aspects of a SOA, you must also look at two key design considerations. First off, for a SOA to offer value it must leverage existing investments. Service-enabling existing systems increases the usefulness and value of those systems. Suddenly, existing systems can be used in new ways and pressures to update those systems decrease. For example, Web-service-enabling a custom-built warehousing system means that it can be easily integrated into your pick, pack, and ship process.

In addition, SOA embodies the concept of loose coupling. When the interface is abstracted out, changes in one system do not affect others. This reduces the cost of change, by eliminating the need for extensive retesting if one minor change is made within one system. Because the systems are not directly dependent on each other, changes in one system are not likely to percolate to another system.

**EXPOSING SERVICES**

**Pervasive Web Services**

PeopleSoft Enterprise applications have been ahead of the curve in terms of Web services. Since PeopleTools 8.42 was introduced, PeopleSoft Enterprise applications supported the concept of Web services by providing the capability to produce and consume Web services. This enabled for PeopleSoft Enterprise applications to communicate with each other – or 3rd party systems, which radically reduced the cost to integrate an application.

Within PeopleSoft Enterprise applications, almost any business logic can be exposed as a Web service through the integration broker. This means that the business logic contained with any PeopleSoft Enterprise application can be release and used across the enterprise.

**Integration Broker Architecture**

The Integration Broker provides the basis for Web service functionality contained in PeopleSoft Enterprise applications. This includes the ability to produce and
consume industry standard Web services. The Integration Broker itself consists of several PeopleTools technologies:

- **Application Messaging.** Messaging architecture for both synchronous and guaranteed delivery asynchronous integration into and out of the Integration Broker. Application Messaging is really the heart of the PeopleSoft Integration Broker.

- **Component Interfaces.** Object-oriented, request/reply, component architecture that encapsulates PeopleSoft data, business logic and security.

- **Application Classes.** A new interface for accessing application objects at a higher business level.

- **File Interfaces.** Robust file processing capabilities for file-based integration—still a common method for addressing integration requirements.

- **Service Designer.** A wizard driven framework to create and deploy Web services.

**Service Designer**

With the release of PeopleTools 8.48, the Integration Broker suite of tools will further enhance functionality to support a service oriented, Web service standards driven approach to integrating application systems together. Key to that is the tool called Service Designer. Service Designer provides customers with the capability to easily convert PeopleSoft publicly available Enterprise Integration Points into standards based Web services that can be leveraged to deliver loosely coupled integrations.

The primary function of the service designer is to expose PeopleSoft Enterprise application interfaces as standards-based Web services. This is accomplished by converting all existing application messages, application classes and component interfaces into service operations. Conversion to service operations is automated at upgrade time and provides backward compatibility for existing integrations that leverage integration broker. These service operations provide the core basis to expose application logic as a Web service. In addition, Service Designer offers several other new features

- A Worklist API is offered so that external workflow events can be integrated with PeopleSoft Enterprise Worklist. This enables you to make sure that knowledge workers are aware of activities that require their attention.

- With Service Designer, services can be versioned which enables for less brittleness. This means that new services can be created without breaking any contracts with a previous service.
Transformation

Integrating with different systems means accommodating multiple data models. For instance, if a PeopleSoft CRM application publishes out customer data to two subscribing systems, the structure of the customer data being sent may have to be altered so that it can be consumed by the other systems. For this reason, transformation capabilities are a requirement of an integration broker in order to manage this data exchange.

Transformation logic can be defined using Oracle XSLT Mapper, which is bundled with PeopleTools. Oracle XSLT Mapper utilizes an open standard (XSLT) for data mapping. By using the Integration Broker, you can store your mapping definitions in one place so that if the data model of one of your applications changes, you can reflect that change outside of your PeopleSoft applications. Having fewer points to change means lower cost in maintaining integrated systems.

The XML message definitions and processing logic become building blocks for connecting one or more systems into that business process. Since transformations and end-point destinations are administered independently of messages, you can reuse the XML message interface to accommodate multiple requestors or providers of a business process.

SOA Design Patterns

Our goal is that any system should be able to access PeopleSoft components and integrate seamlessly with PeopleSoft systems using standard internet protocols. XML over HTTP has been key to this.

The PeopleSoft Integration Broker facilitates the use of Web services for interacting with other systems, as well as exposing the business logic in any PeopleSoft application. Any discrete component of application functionality can be exposed as a Web service. Examples include product inventory, employee address, and customer profile. Any of these application components can be published and accessed behind the firewall or over the internet as Web services.

Integration Broker supports both point-to-point connectivity directly through integration broker and enables PeopleSoft services to be consumed and orchestrated through Middleware Service-Oriented Architecture Suites that support standard Web services. This means that Web services from PeopleSoft can be utilized in a variety of ways; here are the three primary use cases:

- PeopleSoft Enterprise to PeopleSoft Enterprise
- PeopleSoft Enterprise to 3rd Party
- PeopleSoft to Many

Standards Support

While PeopleSoft Enterprise applications supports a broad range of standards throughout its infrastructure, the depth and breadth of standards support within
Integration Broker provides the foundation for low cost integration. Some of the standards supported natively include SOAP, WSDL, XML and many others. With PeopleTools 8.48, additional standard support was increased include native WS-Security and WS-Addressing along with UDDI 2.0 and 3.0 Introspection support. Introspection by UDDI is complimented with Web Service Introspection List (WSIL) support.

FINDING SERVICES

Finding Services

The PeopleSoft Enterprise Interactive Services Repository (ISR) acts as a unified model that is used to describe the integration points from all three PeopleSoft product families – PeopleSoft Enterprise, JD Edwards EnterpriseOne and JD Edwards World. ISR provides a mechanism for customers, partners and consultants to discover integration opportunities between PeopleSoft products and other systems. It exposes a large number of Services, Events, Business Processes and Business Models within the PeopleSoft Enterprise applications.

An integration point is marked as either 'Public' or 'Private'. A public integration is one that involves two public integration points and is available for customers viewing data on Customer Connection. Only integration points that are ‘Public’ and ‘Approved’ are exported to Customer Connection. A private integration is one that can never be a part of a public integration and is used as an integration point for internal functioning of the application. The owner has the right to change this integration even deleting it if required. Public integrations on the other hand are supported and available for use and customization.

Following is an example of how ISR represents a business task.
Figure 1: Interactive Services Repository.

**UTILIZING SERVICES**

**Introduction to Oracle Fusion Middleware and Oracle BPEL Process Manager**

Oracle BPEL Process Manager, a part of Oracle Fusion Middleware, provides a comprehensive, standards-based, easy-to-use solution for creating, deploying, and managing cross-application business processes with both automated and human workflow steps—all in a service-oriented architecture. Oracle BPEL Process Manager consumes services from various applications and orchestrates them into a business process. Its native support for standards such as BPEL, JCA, JMS, Web services, XML, XPATH, and XSLT makes it an ideal solution for creating integrated business processes that are portable across platforms. Oracle BPEL Process Manager fully leverages sophisticated features of the underlying Oracle Fusion Middleware platform such as security, scalability, and high availability. In essence, Oracle BPEL Process Manager acts as Oracle’s Business Process Management (BPM) solution.

“As the development of applications continues to shift toward the process-centric viewpoint, the need to easily piece these components together to form a larger business process increases. Oracle’s BPEL Server is a very strong option for meeting this need. . . . Overall, the [Collaxa] BPEL Server is a very capable product and should be considered when building service-oriented architectures.”

—*Web Services Journal*, August 7, 2004
Oracle BPEL Process Manager interacts seamlessly with PeopleSoft Enterprise Integration broker, easily receiving Web services created in PeopleSoft Enterprise. These Web services can start a process within Oracle BPEL Process Manager or send a signal to Oracle BPEL Process Manager to continue a process. Oracle BPEL Process Manager can also invoke enterprise services from within PeopleSoft Enterprise.

For instance, if a sales-order process crosses multiple systems before the order can be fulfilled, you can use PeopleSoft Enterprise for sales order management and financials but use a homegrown application for pick, pack, and ship, as described in the steps below.

1. The sales representative enters an order in PeopleSoft Enterprise CRM for a box of widgets.
2. A Web service is initiated within PeopleSoft and is picked up by Oracle BPEL Process Manager, which recognizes the event as the start of a process.
3. Oracle BPEL Process Manager invokes a Web service from the homegrown application to pick, pack, and ship the box of widgets.
4. The homegrown application invokes a Web service to notify Oracle BPEL Process Manager that this part of the process is complete.
5. Oracle BPEL Process Manager notifies PeopleSoft Enterprise CRM that it should mark the order as shipped and then passes the information to PeopleSoft Enterprise FMS.

Developing in a Service-Oriented World

Oracle JDeveloper provides the mechanism for doing development in SOA. It offers a single, unified tool for developing all the aspects of a service-oriented architecture enabling you to develop a custom Web service or creating a business processes with Oracle BPEL Process Manager.

Leading the charge in Oracle JDeveloper is the Application Development Framework (ADF), which consists of multiple programming models, including a method of creating a business services layer where business logic can reside to be used across ADF components.

MANAGING SERVICES

Oracle’s unique SOA offering includes the ability to manage and secure Web Services through Oracle Web Services Manager (WSM). WSM is a Web Services security and management solution that provides the visibility and control required to deploy Web Services into production. With Oracle WSM, organizations can enjoy a common security infrastructure for all Web Service applications. This allows best practice security policies and monitoring to be deployed across existing or new Services.

How It Works

With Oracle WSM, an administrator creates security and management policies using a browser-based tool. A typical Web Service security policy might be:

1. Decrypt the incoming XML message
2. Extract the user’s credentials
3. Perform an authentication for this user
4. Initiate an authorization check for this user and this Web service
5. Write a log record of the above information
6. If all steps are successful, pass the message to the intended Web Service
7. If not, return an error and write an exception record

The WSM product would then intercept every incoming request to a Web Service and apply the policy above. As the policy is executed, the WSM collects statistics about its operations and sends these to a monitoring server. The monitor displays errors, service availability data, etc.

As a result, each Web Service in an enterprise network can automatically gain security and management control, without the Service developer coding extra logic into the Service.
Key Features

- **Web Services Access Control and Single Sign-On.** Oracle WSM provides single sign-on, including authentication, authorization, and auditing for Web Services. It supports authorization based on information contained in any part of the XML message or body, and provides access control at Service or SOAP method level. The WSM supports WS-Security, SAML, and XML Signature.

- **Centralized Security Policy Management with Localized Enforcement.** Oracle WSM allows organizations to minimize the duplication of effort required to build security into each service by leveraging a centralized security infrastructure. The Oracle WSM solution provides the ability to add best-practice security to an existing Web Service, without requiring re-work of the Service’s code.

- **Unified Monitoring of Cross-Organization Web Services Applications.** Today, companies are struggling with how to capture the data that they need to provide adequate audit information as required for regulations such as Sarbanes-Oxley, Gramm-Leach-Bliley, and HIPAA. Oracle WSM allows companies to leverage a common audit records that show which users or applications have accessed any Web Services and which actions they have performed.

Key Benefits

- **Increased Security.** Oracle WSM enables consistent application of security policy across both Web and SOA environments. This ensures that corporate standards are uniformly applied, enforced, and monitored across your IT systems.

- **Lower Development Costs.** With Oracle WSM, application developers can leverage a common set of tools and do not have to build security features into each application or Service.

- **Easier Compliance Reporting.** Automated monitoring provides the visibility required to track all of the events and transactions that are happening across multiple Web Services.

CREATING COMPOSITE APPLICATIONS

Once you have the SOA components, you need to create a composite application that uses them. Composite applications consist of a collection of services and business events. This collection is then orchestrated or assembled to complete a business process within an application or across multiple applications. Once you have a composite application, you can quickly modify it to handle changes in corporate requirements.

By putting together all of the SOA components, you can create business flows. Business flows, created in Oracle BPEL Process Manager or any non-Oracle-based
BPM product, can use enterprise services offered by PeopleSoft Enterprise Integration Broker to string together a process encompassing other applications and display them all through Oracle Portal.

**Intelligent Orchestration: Improving the Flow**

Creating and modifying business processes alone won't give your company a competitive edge; you must also be able to monitor and improve them. You have to keep an eye on key performance indicators to ensure that your business is performing according to plan.

A component of Oracle Fusion Middleware, Oracle Business Activity Monitoring (Oracle BAM) enables you to define monitoring points to provide insight into business flows for reporting, analytic, and performance improvements. Oracle BAM offers a dashboard so you can understand your business processes and key performance indicators.

**Adding an Employee in Service-Oriented Architecture**

Let's say a new employee joins your firm. When a new hire is entered into PeopleSoft Enterprise HCM, a Web service is created that notifies Oracle BPEL Process Manager to start a process. Then Oracle BPEL Process Manager sends an e-mail to the new employee, asking him to access Oracle Portal, where he can select his benefits and order his computer, after which Oracle BPEL Process Manager can use a third-party service to provide him with his corporate credit card. Finally, a Web service is invoked to pass the employee information to security, so that the employee can get a badge on his first day. This is just one example of how a business flow can use Oracle technology to create an adaptable business process.
Although PeopleSoft Enterprise is tightly integrated with Oracle Fusion Middleware and customers can decrease their time to value by leveraging the products together, Oracle recognizes that customers may have made other middleware decisions. Because PeopleSoft Enterprise uses Web services, it’s easy to integrate any middleware—IBM, Tibco, webMethods, or BEA—as long as it supports standard Web services.

**SUMMARY**

This white paper has demonstrated how PeopleSoft Enterprise and Oracle Fusion Middleware work together to enable CIOs to coordinate the elements of their diverse software portfolio to act as one. Facilitating events and Web services with PeopleSoft Enterprise gives CIOs a foundation of business process components they can leverage to solve a myriad of problems and rapidly respond to changing business requirements.

This solution is extended through any standards-based middleware, such as the industry-leading Oracle Fusion Middleware, which enables CIOs to quickly modify or change business processes by leveraging Oracle BPEL Process Manager. In addition, they can monitor and improve services by using Oracle Business Activity Monitoring or secure the services by using Oracle Access and Oracle Identity Management. When everything works together, you have the most complete and mature foundation for adaptive business processes.