



# A Practical Approach to Enterprise Integration

DoD's Standard Procurement System

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Implementing enterprise integrations can be complex and daunting, especially for organizations with a legacy information technology environment. The practical approach to integrations should result in maximizing return on investment and achieve a forward-looking, flexible architecture aligned with broader enterprise architecture goals

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and the emergence of new technologies in the marketplace. In this article, we will shed light on determining and implementing such practical strategies for an organization's IT and business integration needs as well as highlight key aspects of the Standard Procurement System legacy integration strategy. SPS is one of the Department of Defense's contract writing systems, deployed to more than 23,000 users at over 750 sites worldwide. The program is managed by the SPS Joint Program Management Office (JPMO) within the Business Transformation Agency.

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wide model that sets a foundation for sharing data and capabilities across all applications of a business enterprise even as they are modified or replaced.

**Integration Strategies**  
Integration technologies and concepts have evolved over the last decade, leading to a multitude of architectures and products in the IT market. Once you get past the marketing hype, however, there are really three broad integration strategies:

**Point-to-Point**  
In a point-to-point integration approach, each application is integrated directly with the other application via an interface module.

**The Need for Enterprise Integration**

IT environments at government and large corporate organizations are usually a result of years of evolution as business practices have changed and grown, and as new systems have been deployed. The systems include commercial off-the-shelf, government off-the-shelf, and custom applications that fulfill specific business needs for the organization. Not surprisingly, these applications are built on different technologies with unique architectures and have their own specific data formats for their business transactions. As a result, applications lack a way to share data or services, leading to islands of information and business capabilities within an organization. Such disconnected environments lead to duplication of data entry, information discrepancy, and lack of information visibility across the enterprise. How can organizations get around this problem?

The answer is enterprise integration, which is the industry term for real-time information exchange across the various business functions of an enterprise. However, integration can be complex and expensive. There are many integration software vendors in the marketplace that offer integration solutions. Instead of attempting to pick a specific tool or technology for implementing your integration solution, the first step is to determine the integration strategy that will best achieve your business needs. The integration strategy should implement a long-term, enterprise-

wide model that sets a foundation for sharing data and capabilities across all applications of a business enterprise even as they are modified or replaced. As shown in Figure 1, each line represents a distinct interface module between the various applications. The interface module contains all of the necessary business rules to extract and transform data between the two applications being integrated.

While interfaces of this type can be built and implemented relatively quickly and cheaply, the approach has limited consideration for enterprise-wide data integration. As more applications are interconnected with each other, the number of integration modules you need to build and maintain multiply exponentially. Additionally, those interface modules are directly impacted by underlying application upgrades and data changes. You should use a point-to-point integration approach only in an environment with a very limited set of legacy applications that are in sustainment and are not expected to be modified over time.

**Enterprise Application Integration**

The EAI approach is based on a hub-and-spoke integration methodology. This approach consists of a central hub that houses and executes all of the integration logic for the enterprise. Business applications communicate via the hub and not directly with each other. As shown in Figure 2, the enterprise hub is typically supported by a specialized application known as the *EAI middleware*, which

Figure 1: Point to Point Approach

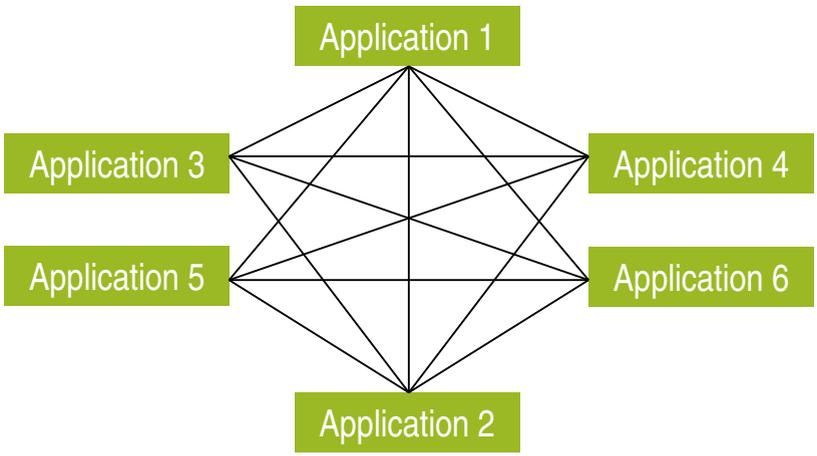
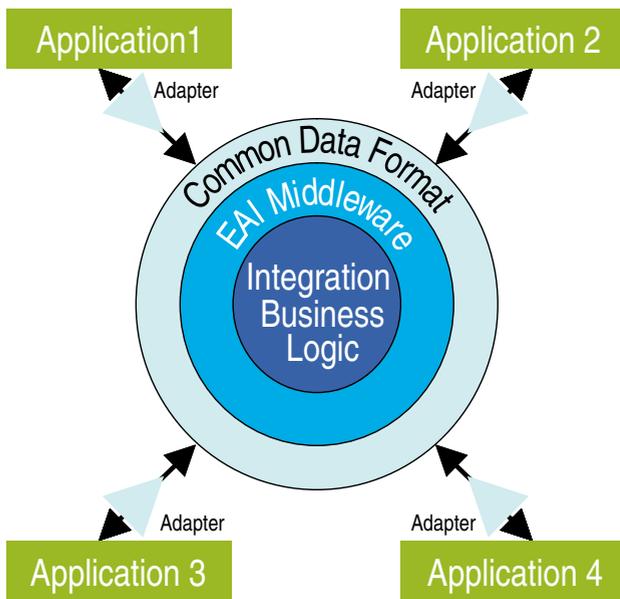


Figure 2: **EAI Approach**



acts as a message broker, routing data exchanges between multiple applications. EAI middleware applications are available as commercial off-the-shelf products from companies specializing in integration technologies.

Underlying an effective EAI strategy is the implementation of a standardized enterprise data model. The standardized enterprise data model defines the structure and data elements for the business transaction of your organization. This allows for business applications to interface directly to the standardized data model instead of to each other. Each application's interface logic is coded in a module known as the *Adapter*. With this approach, the integrating applications can continue to be modified over time without having a direct impact on the other integrations, so long as the standardized data model does not change. Therefore, cross application dependency is minimized. Moreover, this architecture allows for a central data store for the integration of business processes and provides a single point of control for maintaining data integrity. The centralization of transformation, communication, security, and other business processes leads to easier maintenance and consolidated visibility.

**Enterprise Service Bus Integration**

The ESB Integration strategy is also based on the hub-and-spoke integration topology. With the advent of open, Web-based, and service-oriented business applications, EAI middleware applications have evolved to support Web-based communication standards such as SOAP, XML, HTTP, and other services. This new breed of service-oriented architecture-based integration middleware applications is known as ESB middleware.

As shown in Figure 3, with this approach, enterprise systems need to be capable of exchanging corporate data

and business services across applications using standard Web-based formats and Web services. For legacy applications lacking a Web-services interface, that is achieved by developing an external layer of code often termed the *application wrapper*. The application wrapper allows for legacy business functions to be openly available for use as enterprise services. The application wrapper contains code to transform data and functions to a standard Web format for communication between the application and the ESB.

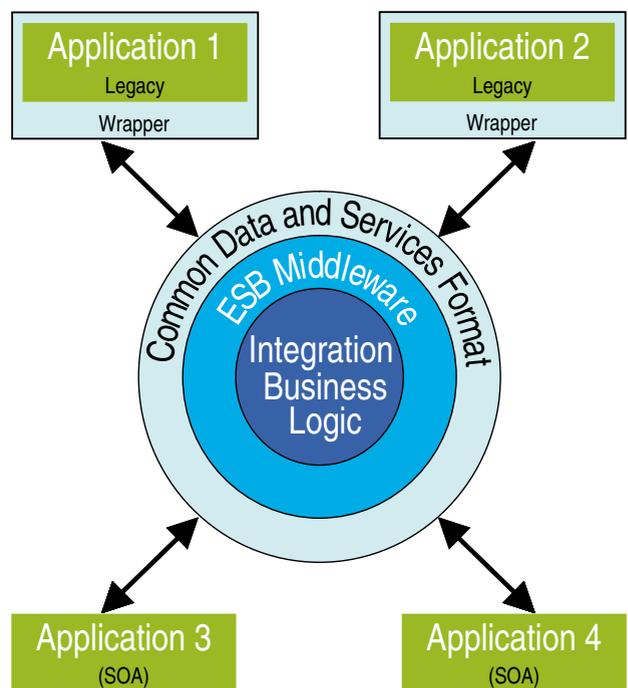
You will find many organizations implementing ESBs as part of their corporate integration strategy in conjunction with a service-oriented architecture. Like the EAI strategy, the ESB architecture allows for a central data store for the integration business processes, and it provides a single point of control for maintaining data integrity. If done correctly, it can lead to a very nimble IT organization that can adapt to changing business needs rapidly by allowing business applications to plug and play as and when needed.

**The SPS Legacy Integration Strategy**

Contracting data is at the epicenter of business transactions spanning financial, logistics, requisitioning, and contract management systems. When SPS was being implemented in the late 1990s, part of the requirement was to subsume interfaces to legacy financial and logistic systems from the contract writing systems that SPS was replacing. Consequently, point-to-point interfaces were developed.

The major technical challenges in developing and implementing an SPS integration strategy included:

Figure 3: **ESB Approach**



**Stovepiped legacy systems**—The external systems were primarily stovepiped applications with limited interface capability.

**Lack of a standard data format**—There was no single standard data format for the business transactions that needed to flow across the systems.

**Need for unique business rules**—Because each legacy application had proprietary data structures and formats underlying their business transactions, the transformation rules and integration logic had to be tailored for each application being integrated.

By 2002, technology had improved, and the SPS JPMO was able to move away from the point-to-point interface concept and to leverage the SPS Adapter as part of a hub-and-spoke legacy integration approach with a centralized integration hub. The SPS Adapter allows the application to communicate and interchange data and business transactions with external applications. Examples of business transactions include solicitations, purchase requests, contract awards, award modifications, and vendor updates. The SPS Adapter uses a third-party product called webMethods™ as the middleware platform to achieve the data exchange.

The SPS hub-and-spoke-based integration model strikes a good balance between being flexible, feasible, and cost-effective. It is an example of a practical approach that can be leveraged by other organizations in similar situations. Today, SPS interfaces to more than 20 business applications at more than 200 military installations worldwide. Some of the key benefits of the SPS legacy integration strategy are:

**Standardized integration architecture**—All of the legacy external systems are integrated into SPS using a standard architecture approach. The integration logic is maintained centrally within a webMethods-based integration hub. The integration hub executes all of the unique data transformation rules and business logic required for the data interchange between SPS and each of the legacy external systems. In the current environment, each database server site has an instance of the integration hub.

**Centralized development approach**—The data transformation logic and business rules are developed and maintained within code modules called *translators and integration com-*

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*ponents*, which reside within the integration hub, providing a single location for ongoing development and maintenance.

**Real-time execution**—The integration hub allows for data to be interchanged in a real-time fashion. For, example, a contract award that is approved and released by a user within the SPS application simultaneously triggers all of the integrations that require awards to be sent out to external systems.

**Central administration of integrations**—The system administration is centralized and all of the data interchange is visible within the webMethods consoles. Additionally, the integrations generate detailed logging and statistics of the transactions.

Overall, this architecture approach is dynamic and flexible, allowing for integration business

rules to be modified and maintained over time and for new technologies to be adopted as they become available. For example, the SPS integration architecture is already leveraging Web services as legacy applications are being replaced with more modern systems.

**Lessons Learned**

With the rapid advancement of integration technologies and architectures from commercial vendors, business organizations are faced with a complicated landscape of integration strategies and tools to choose from. It is important to maintain a simplified view of the integration landscape and consider the attributes and characteristics of the current IT environment when developing an integration strategy. In general, a hub-and-spoke-based approach provides the best flexibility for the ongoing evolution of your integration architecture. As organizations transform technologically to have standard communication protocols and Web services-based applications, integration will inherently be part of the overall IT strategy. The practical approach is to take well-calculated steps that enable your organization to implement the right foundation and function in an integrated fashion without overachieving and overspending.

*Note: This article was written solely by Universal Consulting Services and not at the request of any government agency.*

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