Designing for Variety and Change in SOA: Composite Service Adapters

A White Paper
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Abstract

For Service Oriented Architecture (SOA) projects to be successful, they must accommodate a high level of variety and change involving a large number of systems, applications, data formats, standards, and connectivity types — all existing in a perpetual whirl of change for both legacy systems, unstructured data sources (e.g. report files), and new applications. Driven by business and technical factors, this growing volatility makes the goal of establishing a workable and maintainable SOA strategy hard-to -achieve.

Many of today's Web Services orchestration platforms use data manipulation and integration techniques that assume XML as the source and target messages and rely heavily on XSLT to solve most, if not all, transformation problems – such approaches cannot easily accommodate variety and change found at the end-points of the Enterprise Service Bus (ESB). As a result, implementation cycles are prolonged by lengthy Java or C# programming projects. At the same time, dealing with inevitable change at one level requires a corresponding — and costly level of change in the other layers of the integration stack. This rapidly increases the costs around integration and, over a period of time, dwarfs the initial license cost. A new mechanism for managing the "last mile" is needed.

Composite Adapter Services offer a fresh approach — a more adaptive last mile architecture for business integration that provides flexible technologies for connecting to legacy databases, unstructured data, and applications, while offering a standards-based, composite view of granular business objects to the Web Services orchestration platform or ESB container.

The addition of rapid and reusable Composite Adapter Services can address this problem by establishing flexible integration layer between high-level business process orchestrations and lower-level IT infrastructure components. Based on a extensible adapter framework, built with a visual design environment and employing a process metaphor rather than a language metaphor, these Composite Adapter Services provide detailed integration process specifications that are surfaced as services at multiple levels of granularity. They fully separate relatively stable business processes from the large variety and constant change found at the data and application layer.

Using Composite Adapter Services as the key building blocks of a flexible integration strategy, SOA can accommodate variety and change, and deliver on the promises of the agile enterprise.

Variety and Change: The Challenges of Integration

The pressure to find new and better ways to integrate IT systems across the enterprise increases every day. A true interconnection among heterogeneous business systems, departmental data, and trading partners is essential to significantly lowering the cost of ownership of applications. What's more, successful integration can help organizations understand their markets and customers better, replace or upgrade applications in a non-disruptive manner, provide better business intelligence, interface with partners, and add value to all existing applications by finding new ways to leverage vital systems and data.

However, one major obstacle still remains for successful integration: today's highly diverse and varied IT landscape and the factors that lend to it:

1) Legacy environments:

Many organizations still have legacy systems that account for a high percentage of their application functionality and data storage. According to analysts at Forrester Research, there are some 200 billion lines of COBOL in legacy systems still in use. Nor is it going away. Maintenance and modifications to installed software increase that number by five billion lines a year. IBM claims that its CICS mainframe transaction software handles more than 30 billion transactions per day, processes $1 trillion in transaction values, and is used by 30 million people. An integration platform that misses key legacy data format connectors is only solving a small piece of the integration puzzle.

2) Complex client/server computing:

In the 1980s we began to see client/server computing and the decentralization of IT purchasing . What followed was the immediate and widespread use of a hodgepodge of departmental IT systems and tools throughout the organization. Software asset management, version control, licensing, and a host of other issues that were commonplace in the mainframe era became major issues, increasing the difficulty of integration.

3) Hard-wired applications:

In the 1990s, we saw the emergence of large Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), Supply Chain, and other applications. This led many integrators to assume that point-to-point, custom-integration mechanisms were completely acceptable. Many hard-wired integration points were created and remain there today. Unfortunately, these IT systems with their brittle APIs have created performance and maintenance nightmares that still plague almost every IT shop.

4) The proliferation of eCommerce:

One of the most explosive trends in IT is the need for connectivity outside the firewall. Enterprises of all sizes, in order to remain competitive, must be able to deliver seamless B2B integration with customers and suppliers. Of course, this dramatically expands the number of disparate and incompatible data and application formats.

5) The emergence of hosted applications:

Organizations are always looking for ways to reduce the cost of IT infrastructure. One of the emerging options is the move toward using Software as a Service (SaaS) or more commonly known as Application Service Providers (ASPs). While this option offers a more economic model, it also expands and complicates the types of end-points for which an integration strategy must plan. The IT infrastructure now includes Internet-reachable Web Services APIs provided by the ASP vendor.

6) Constantly changing business environments:

Solving the variety problem is only the beginning — the second obstacle to integration is an even bigger challenge. The constantly changing business imperatives and merger and acquisition activities that drive business have ensured that no single business system or IT stack will remain static for long. All systems are part of an evolving ecosystem of applications, systems, databases, trading partner networks, and more. The result is that each link in the integration chain can (and will) break on a frequent basis. Being unable to rapidly and economically adapt to this constant change is the single biggest cause of integration project failure.

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Most Integration Approaches Lead to Failure

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Over 95% of all application integration projects fail, according to a 2003 study by The Standish Group International Inc. IT staffs either significantly exceed their budgets, fall behind schedule, or fail to accomplish their goals. These failures are due, in large part, to integration approaches that cannot accommodate variety and change. For example, many traditional, static approaches rely on proprietary or system-specific platforms that build-out (typically with custom code) synchronous and tightly coupled integration directly between the business process layer and the IT infrastructure. Occasionally, pre-built adapters work for a period of time, but they often provide only hard-wired, bi-directional connectivity to a handful of applications and data.
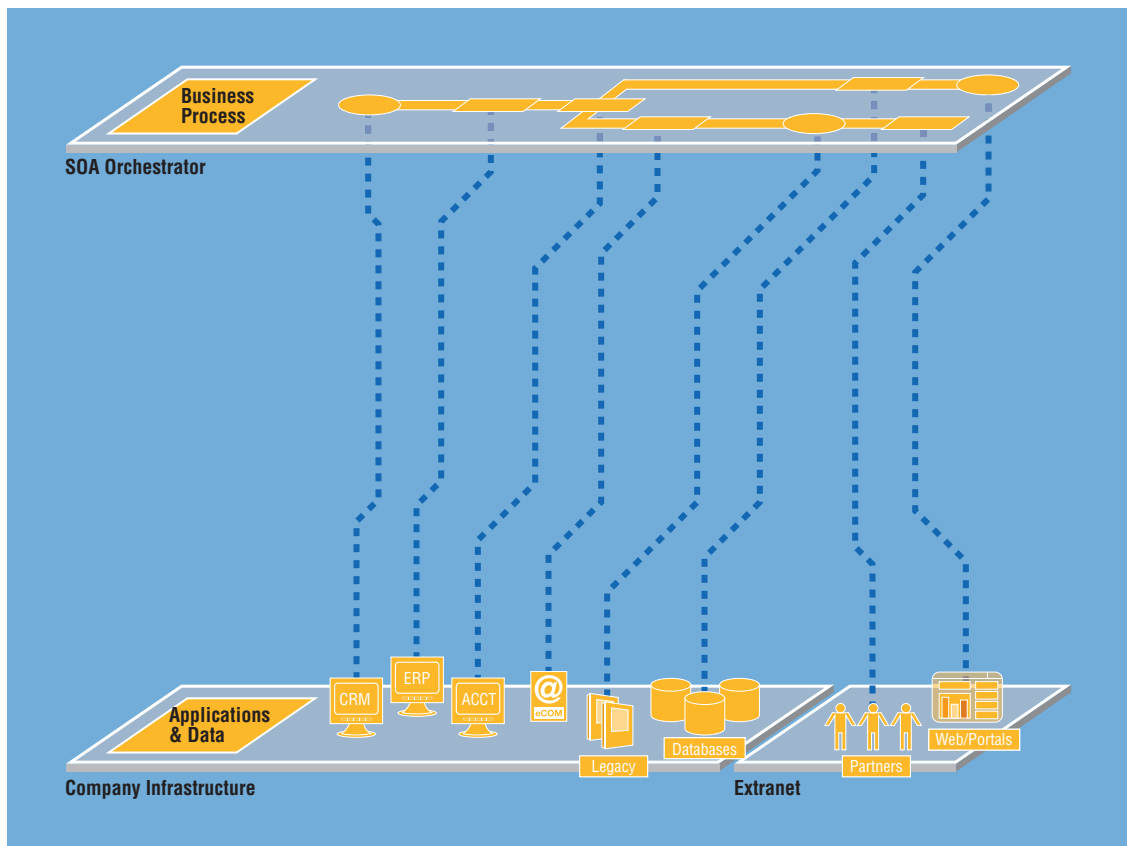
Hard-wired or legacy Enterprise Application Integration (EAI) connectivity fails to accommodate variety and change.

The Web Services orchestration servers of today allow business analysts and process experts to document process flows that cause immediate, actionable changes to how IT systems exchange data and events.

However, many of today's products flounder on the variety problem — often spilling out generated code skeletons that need to be filled in by expert developers with thousands of lines of custom code. This additional code is required for two reasons. First, today's infrastructures have a huge variability in connectivity requirements. One size does not fit all.

Second, BPM and SOA orchestration vendors often provide, at a high cost, only the basic hard-wired ERP/CRM adapters and simple XML transformation capabilities — but nothing else. As a result, full integration still requires significant custom coding — a time-consuming, labor-intensive, and very expensive process.

To compound these problems, when the IT infrastructure inevitably changes, the business process flow no longer matches the underlying code, so the process flow requires revision, redesign, and refactoring of existing code into newly regenerated skeletons.

Opportunities with Composite Service Adapters

Over the past few years, Composite Adapter Services have emerged as a promising alternative to traditional code generation approaches to SOA. Composite Adapter Services execute self-contained, reusable, application-based units of work – with a heavy dose of integration "glue." They can include business functions, transactions, or system service functions. Examples of a composite service might be Show Balance, Check Inventory, Place Order, or Receive Shipment, all aggregating data from disparate systems.

These services are engaged between Service Requestors and Service Providers. A Service Requestor or Consumer can be an ESB/BPM/EAI flow or another application or another Composite Service Adapter. A Service Provider is any application, database, legacy system, or component that has exposed or published its services conforming to industry standards. These services are sometimes discoverable through a registry (e.g., UDDI), and they can offer powerful, late-binding, metadata-rich descriptors. In a SOA-based activity, the Service Request/Response can be synchronous for tightly coupled transactional needs or asynchronous so that business processes can continue independent of response. Many implementers are finding that a message-passing architecture based on loosely coupled, coarse-grained principles is more robust, flexible, and scalable.

Service Consumers and Service Providers can be connected ad hoc to help build out integration on an incremental basis, or connected through an ESB. The ESB provides message-oriented middleware between the business process layer and the IT infrastructure as well as service registries.

Services interfaces expose application functionality to Service Consumers. Services use open-system protocols and standards such as Simple Object Access Protocol (SOAP), Extensible Markup Language (XML), J2EE Connector Architecture (JCA) and Message-Driven Beans (MDB). More powerful than pure HTTP and HTML, these services provide flexible, platform-neutral capabilities for messaging between the IT infrastructure and the Business Process layer. SOA and Composite Adapter Services are being adopted across a range of industries by large and medium   businesses. "The market-at-large is embracing the concept of SOA to such a degree that it could inevitably leave a mark on IT environments for many years to come," says Sandra Rogers, director for Web Services Software and

Integration at IDC.* Spending on Web Services projects should hit $11 billion by 2008, according to IDC researchers, a rise from $1.1 billion in 2003.**

"Rigid" SOA
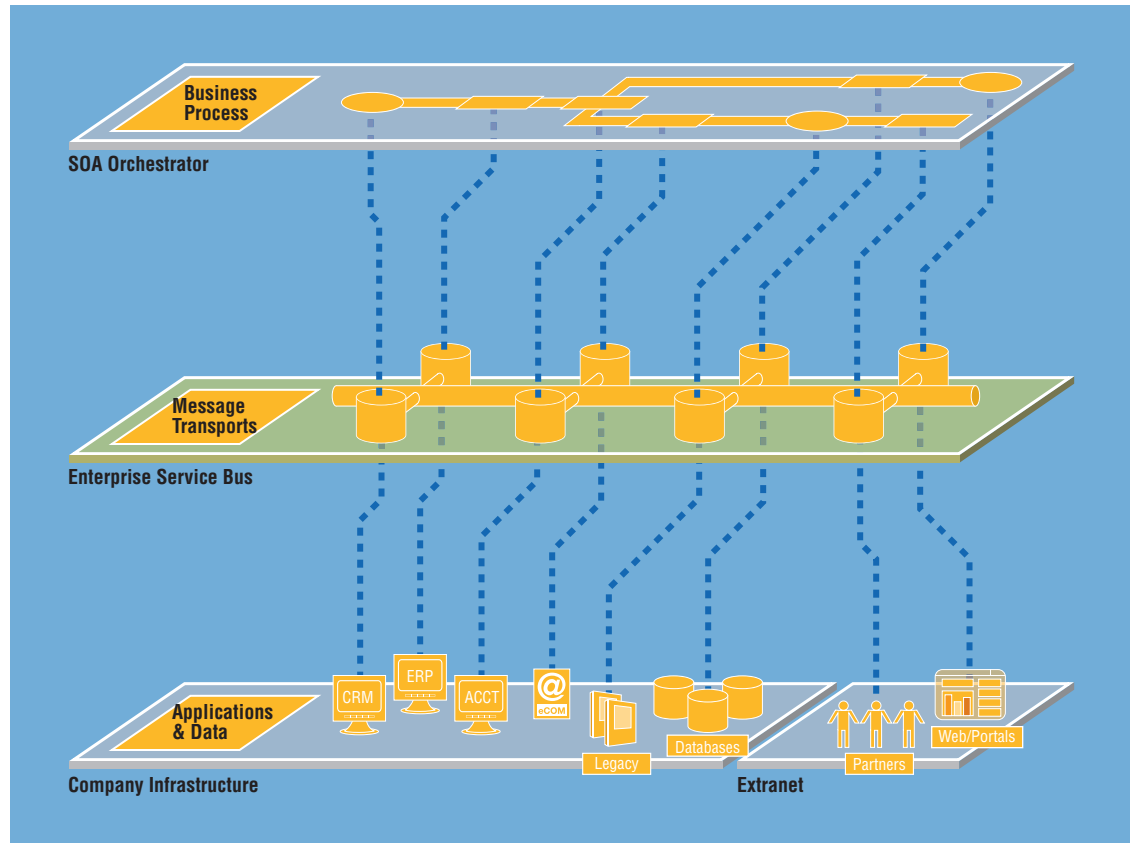
An architecture with BPM engines calling custom-coded SOA services is limited by rigid, unmaintainable application coupling that is inappropriate for today's volatile IT environments.

SOA promises to provide a strategic foundation for enterprise integration. However, history has taught us that any enterprise architecture that does not address the challenges of variety and change from a more loosely coupled standpoint is destined to encounter significant problems. The average corporation in the U.S. today has over 70 disparate application systems. Some Global 2000 companies have thousands. The number and complexity of these systems will only continue to grow, and solutions for integration will have to accommodate an increasingly volatile and rapidly evolving IT infrastructure. Although relatively stable compared to the IT infrastructure, business processes can also undergo radical changes based on new business models, product offerings, and mergers/acquisitions. When you factor in the explosion of connectivity needs outside the firewall (businesses to other businesses, consumers, or government regulatory requirements, it becomes apparent that variety and change are the killer dimensions of the integration challenge.

Therefore, an enterprise architecture based on SOA, addressing only high-level business process flows with some kind of backbone "bus," is not enough.

* From "What's Driving Web Services Adoption?" *Web Services Advisor* newsletter.

** From IDC white paper, 2003.

To fully accommodate variety and change, a more thoughtful strategy paired with a Composite Service Adapter platform must be deployed between the business process and lower-level IT infrastructure bindings.

Managing Variety and Change with Composite Service Adapters
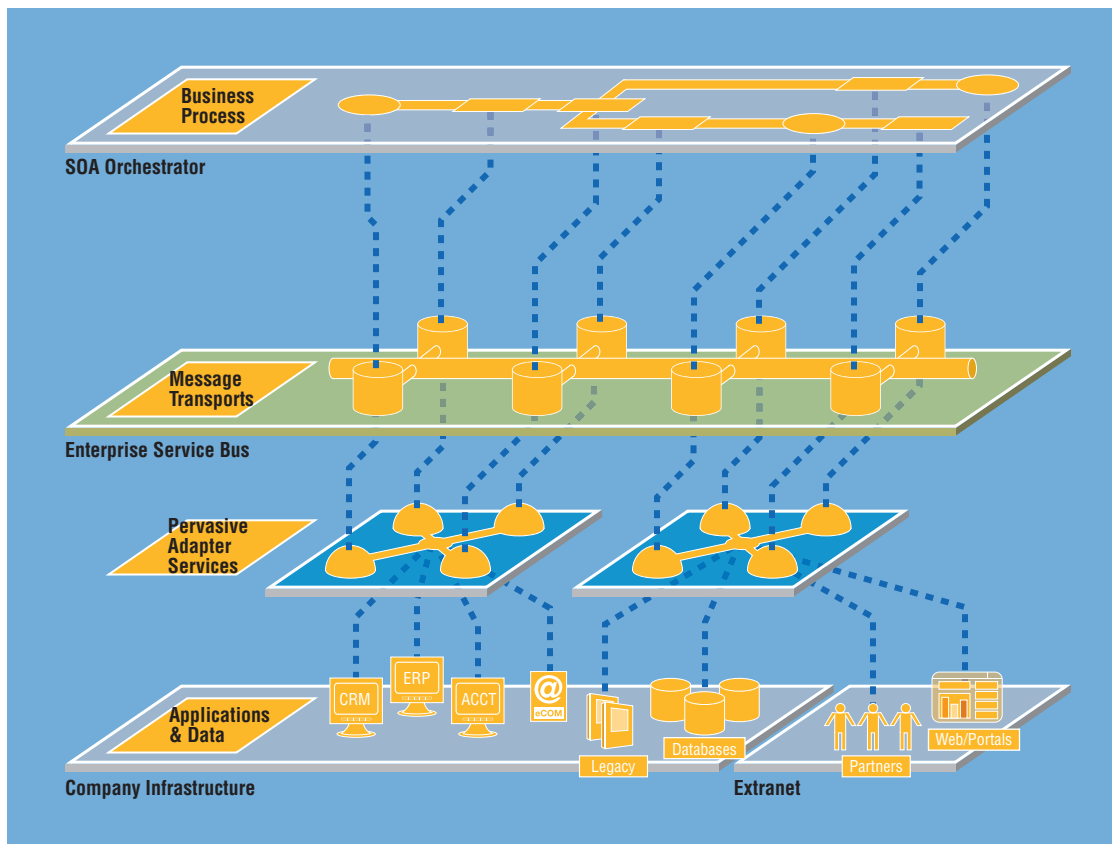
Pervasive Adapter Services for SOA (in blue) enable true, loose coupling between the business process engine and IT infrastructure so that each can be changed and developed independently of the other.

The illustration above shows an example of a complete SOA-based architecture with multiple opportunities for Composite Adapter Services to provide the supple "glue" between continually changing end-points. The business process layer is not connected to the IT infrastructure in a direct, hard-wired way. Instead, it is loosely coupled through a platform that enables the development, deployment, and management of distributed custom or pre packaged Integration Processes. These composite services are the detailed integration processes (what Gartner also calls Composite Applications) available for orchestration depending on the ever-changing needs of the business process.

Any business process contains a number of activity steps such as "send PO" or "receive invoice." Any single step may delegate work to a lower-level service that should itself be a Composite Service Adapter, perhaps containing sub-processes to achieve the right amount of granularity and reuse, executing the detailed integration work. All of this is developed with a set of high-productivity visual tools and relies on a common and open metadata

layer. These specific Composite Adapter Services are the fully adaptive and distributable components of an agile integration infrastructure — one that is architected to weather variety and continuous change.

Composite Adapter Services fully separate the relatively stable business processes from the variety and change found at the infrastructure level. Then, any new business process can discover available Composite Adapter Services and provide a palette of available business actions.

Adaptive composite services also allow well-defined, efficient integration without having to change business processes. Among the many benefits of the process metaphor as the primary building block of integration is the ability to scale and right-size the granularity of the Composite Service Adapter from the simplest tasks (for example, basic heterogeneous message validation and transformation) to the most complex (such as a sub-process that performs multiple coordinated data and application activities). And to nest them in a hierarchical manner —thus promoting maximum reuse and abstraction for the business process layer. Most importantly, all this power and flexibility is achieved while still exposing a simple and standard interface for any Service Requestor.

Building the integration fabric on this open and coherent composite services platform enables an SOA strategy to provide the best of both worlds. On the one hand, Composite Adapter Services enable effective, secure integration between existing business processes and the IT infrastructure, helping the organization take full advantage of the power and functionality of all its applications and systems. On the other, they can fully accommodate variety and change across heterogeneous platforms, allowing the business process layer and IT infrastructure to grow and develop independently of one another.

In addition, this must be coupled with an open, all-XML metadata layer that promotes design-time transparency and reuse, and a centralized management console with a view over the entire distributed fabric of Composite Adapter Services on the ESB. With comprehensive runtime statistics and logfile metadata at your fingertips, you have an integration solution that gives organizations the flexibility to deploy incrementally, and still end up with total overall manageability

Conclusion: Realizing the Long-Term Benefits of SOA

Integration projects of all sizes involve a large variety of connectivity needs that are under constant change. Therefore, business integration projects that attempt to directly marry process to application and system interfaces are likely destined to fail. A more pragmatic approach is to use line-of-business-driven (LOB-driven) projects that solve a specific business integration problem. Essentially, this is the true value of SOA: integration is determined by business requirements rather than technology factors.

These distributed efforts need not be done in absence of a long-term SOA blueprint. In fact, real-world business process management and automation, while understood and driven by top-level requirements, is most successful when built and deployed using a pragmatic, incremental approach, rather than big bang, top-down techniques. However, SOA alone cannot address the enormous volatility of today's enterprise IT environments. Composite Adapter Services provide a layer of abstraction between Service Requestors and Service Providers, enabling enterprise integration that is:

- **Cost-effective**, compared to traditional integration methods
- **Loosely coupled and "right-grained,"** supporting the independent evolution of the business process and IT infrastructure layers
- **Extensible**, with easy addition of new logic and flows via graphical tools
- **Agile and versatile**, supporting multiple platforms and systems — able to bridge the new world of SOA with the old world of IT infrastructure built over the last 30 years

Using Composite Service Adapters, integration architects can fully deliver on the promise of flexible, standards-based integration across the enterprise.

About Pervasive

Pervasive Software is a global value leader in data infrastructure software. The company's award-winning products enable customers to manage, integrate, analyze, and secure their critical data, providing the industry's best combination of performance, reliability, and cost. Pervasive's strength is evidenced by the size and diversity of its customer base, serving tens of thousands of customers in nearly every industry market around the world. With headquarters in Austin, Texas, Pervasive was founded in 1994 and sells its products into more than 150 countries.

Pervasive products are ideal for SOA-based solutions. More information is available by calling 800.287.4383, contacting us at info@pervasive.com, or visiting www.pervasive.com.