Developing SOA Solutions
to Accommodate Variety and Change

A White Paper
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Abstract

Successful integration for today's business 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 and new applications. Driven by business and technical factors, this growing volatility makes the goal of enterprise integration a complex, hard-to-reach moving target for today's IT professionals.

Traditional integration approaches for business processes and the IT infrastructure cannot easily accommodate variety and change. These approaches regularly utilize point-to-point and central-hub connectivity that is hard-wired, brittle, and too fine-grained. As a result, implementation cycles are prolonged. At the same time, dealing with inevitable change at one level requires a corresponding—and costly—level of change in the other layers. This rapidly increases the costs around integration and, over a period of time, dwarfs the initial license cost.

Service-Oriented Architecture (SOA) offers a fresh approach—a more adaptive architecture for business integration that provides more flexible technologies such as Web Services, Asynchronous Messaging, Business Process Management (BPM), and the Enterprise Service Bus (ESB).

However, most SOA implementations today require unwieldy and management-intensive custom code—developed, in particular, to solve the "last mile" integration problem. This makes it very difficult for these implementations to successfully accommodate variety and change. The addition of rapid and reusable Integration Processes can address this problem by establishing an adaptive integration layer between the high-level business process and the IT infrastructure. Based on a common integration platform, built with a visual design environment, and employing a process metaphor rather than a language metaphor, these "microflows" provide detailed integration process specifications which are deliverable as Services at multiple levels of granularity. They fully separate relatively stable business processes from the large variety and constant change found at the infrastructure level.

With integration processes as the key building blocks of a flexible integration strategy, SOA can accommodate variety and change, thereby fully delivering 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 third-party 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: the highly diverse and varied IT landscape today, caused by a number of factors:

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 80s we began to see client/server computing and the decentralization of IT purchasing control. What ensued was the immediate and widespread use of a hodge-podge of departmental IT systems and tools throughout the organization. Software asset management, version control, licensing, and a host of other issues that were absent in the mainframe era became major issues, increasing the difficulty of integration.

3) Hard-wired applications:

In the 90s 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 towards using "software as a service." 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.

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 modern business have ensured that no single business system or IT stack will remain static for long—all are part of an eternally evolving ecosystem of applications, systems, databases, partners, and more. The result is that each link in the integration chain can (and will) break on a periodic basis. Being unable to rapidly and economically adapt to this constant change is the single biggest cause of integration project failure.

Current Integration Approaches: Leading to Failure

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 exist, but they often provide only hard-wired, bi-directional connectivity to a handful of applications and data.
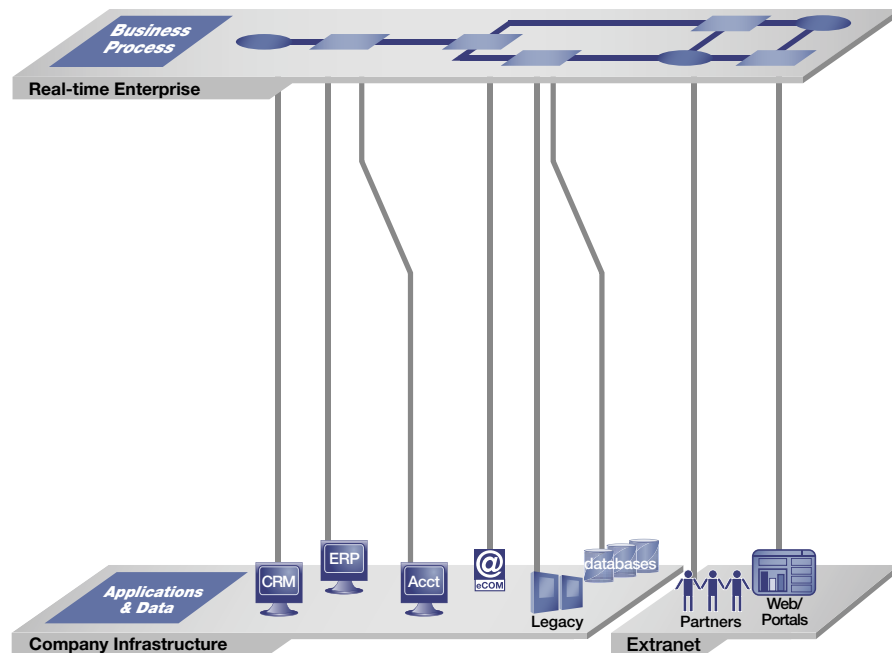
Hard-wired or legacy Enterprise Application Integration (EAI) connectivity fails to accommodate variety and change.

The hard-wired approach, which many refer to as legacy EAI, provides high-level transaction control. However, it lacks the flexibility required to address the two basic integration challenges of variety and change. The hard-wired integration approach limits the IT infrastructure's responsiveness to change. Even with hub-and-spoke topology (many enterprise applications hard-wired to a central, middleware layer), legacy EAI has not proved to be scalable, economical, or efficient for today's enterprises.

Another high-level direction sometimes taken has been BPM, which can introduce workflow management capabilities. BPM is designed to enable semi-technical process experts to document business processes that cause immediate, actionable changes to how IT systems exchange data and events.

However, today's BPM products and implementations can 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 vendors often provide, at a high cost, only the basic hard-wired ERP/CRM adapters—but nothing else. As a result, full integration still requires abundant custom coding—a time-consuming, labor-intensive, very expensive process.

To compound these problems, when the IT infrastructure inevitably changes, the BPM diagram no longer matches the underlying code, so the BPM product requires revision, redesign, and recoding.

Opportunities with SOA

Over the past few years, SOA has emerged as a promising alternative to traditional integration approaches. SOA services are 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 might be Show Balance, Check Inventory, Place Order, or Receive Shipment.

These services are engaged between Service Requestors and Service Providers. A Service Requestor or Consumer can be an SOA/BPM/EAI flow or another application or another SOA Service. A Service Provider is any application, database, legacy system, or functionality that has exposed or published its services conforming to industry standards. These services are sometimes discoverable through a registry, and they can offer powerful, late-binding, metadata-rich descriptors. In an 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 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.

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 its related technologies are being adopted across a range of industries by both large and small to medium-sized 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
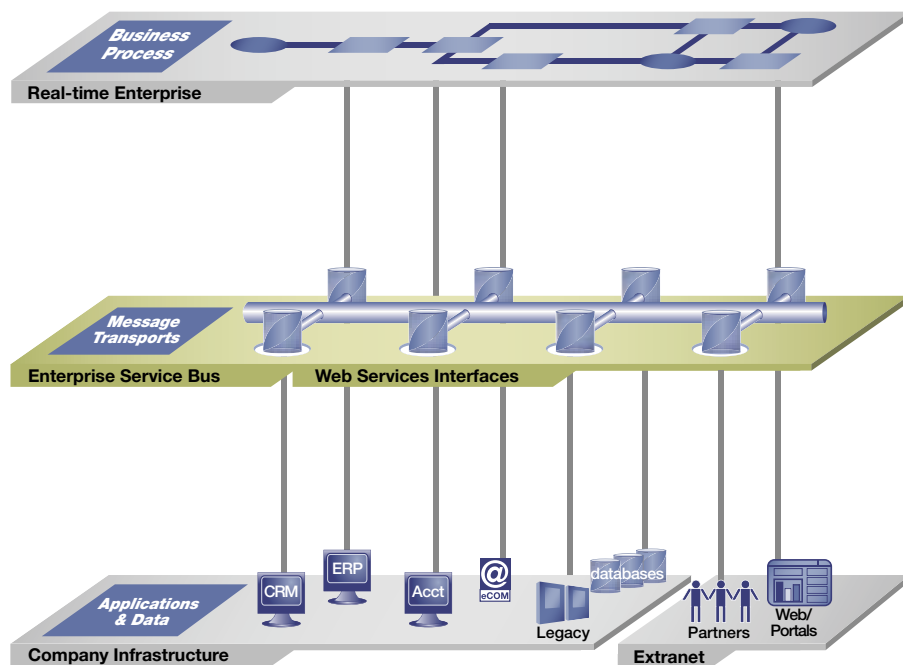
An architecture with BPM engines calling custom-coded SOA services is limited by rigid, unmaintainable application coupling that is inappropriate for today's volatile IT environments.

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 fail.

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

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

** From IDC white paper, 2003.

explosion of connectivity needs outside the firewall (businesses to other businesses, consumers, or government), 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. To fully accommodate variety and change, a more thoughtful strategy paired with an adaptive integration platform must be deployed between the business process and IT infrastructure layers.

Managing Variety and Change with Integration Process Microflows
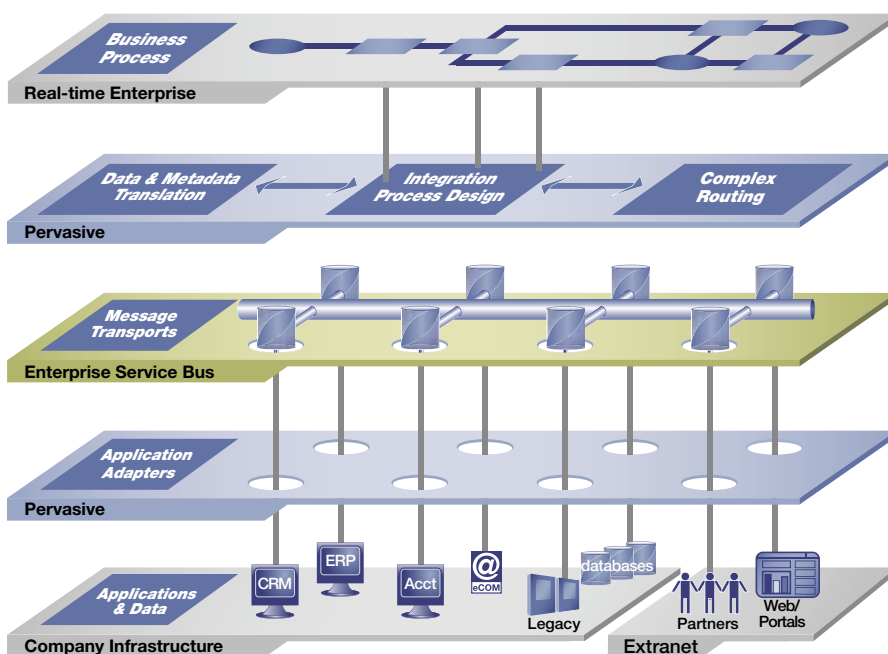
Pervasive microflow layers (in blue) enable true, loose coupling between the business process engine and IT infrastructure so that each can be changed and developed independently of the other.

The illustration above shows an example of a complete, SOA-based architecture with multiple opportunities for Integration Process microflows to provide the supple "glue" between volatile end-points. The business process layer is not connected to the IT infrastructure in a direct, hard-wired fashion. Instead, it is loosely coupled through a platform that enables the development, deployment, and management of distributed custom or pre-packaged Integration Processes.

These microflows 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 Integration Process, 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 microflows are the fully adaptive and distributable components of an agile integration infrastructure—one that is architected to weather variety and continuous change.

Integration Processes fully separate the relatively stable business processes from the variety and change found at the infrastructure level. Once a critical mass of these services exist, any new business process can discover available Integration Services and provide a palette of available business actions.

Adaptive Integration Processes 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 microflows 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 even stack them in a hierarchical manner—thus promoting maximum reuse and abstraction for the business process layer. Significantly, all this power and flexibility is achieved while still exposing a simple and standard interface for any Service Requestor.

Building your integration middleware on this open and coherent platform enables SOA to provide the best of both worlds. On the one hand, microflows 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, you can couple this with an all-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 Integration Processes. With all attendant runtime statistics and logfile metadata at your fingertips, you have a strategic integration platform that gives organizations the flexibility to deploy incrementally, and still end up with total overall manageability.

Conclusion: The Benefits of SOA and Integration Middleware

Integration projects of all sizes involve a large variety of connectivity needs that are under constant change. Therefore, business process projects that attempt to directly marry process to application and system interfaces are 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 determined by business rather than technology factors.

This LOB-driven effort need not be done in absence of the 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 incrementalist approach, rather than now-discredited big-bang, top-down techniques. However, SOA alone cannot address the enormous volatility of today's enterprise IT environments. Integration Process microflows provide a final layer of abstraction between Service Requestors and Service Providers, enabling enterprise integration that is:

- **Cost-effective**, compared to traditional integration methods
- **Loosely coupled**, 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 with multiple models— able to bridge the new world of SOA with the old world of IT infrastructure built over the last 40 years

Using Integration Process microflows, SOA 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.