

# Preparing the Enterprise for Web Services

A Business Overview  
April 2003



With Web services, you can not only deliver value and productivity today, but also prepare your IT infrastructure for tomorrow.

## Executive Overview

Web services are at an early stage, but already companies are finding they can be used to integrate data and applications relatively easily. Today, Web services are the center of attention; vendors, technology analysts, and consulting firms are busily promoting them, while businesses are beginning to use them — and for good reason. Network World<sup>1</sup> reports that Web services are helping to optimize information technology (IT), reduce the cost of creating new applications, increase customer satisfaction, and shorten development time. The reason? Web services offer a way to improve efficiencies in software usage, with technology that can help maintain and grow a competitive advantage.

With Web services, you can not only deliver value and productivity today, but also prepare your IT infrastructure for tomorrow. Web services can help you quickly and efficiently develop new business processes, while driving the creation of new economic models.

Representing the logical evolution of system design, Web services are part of an ongoing trend towards decoupling and distributing system components, enabling each element to operate and evolve independently. Starting with host-centric mainframe architecture, application design has moved through a client-server model to distributed computing. Building on broad industry support based on open standards, Web services are the next logical step in this evolution.

This paper separates the hype from the reality of Web services, discussing what Web services can do today while providing an overview of current technologies, advantages, and potential impacts, as well as what to expect in the short and long term. This document is for business executives, and others, who want to know more about Web services.

1. <http://www.nwfusion.com/techinsider/2003/0310techsurvey.html>, NetworkWorldFusion, Johna Till Johnson, March 10, 2003

# Web services can use existing technologies to extend legacy systems into new applications and services — cost-effectively and efficiently.

## Web Services

Web services have been studied by press, analysts, and vendors over the past few years — as enterprises large and small have started to incorporate the technologies. Market research firms are tracking this initiative, and report that it is gaining traction:

- **IDC**<sup>2</sup>: “Four out of five organizations intend to undertake Web services projects over the next three years. As the size of the enterprise increases, so does the likelihood of adopting these initiatives.”
- **Gartner**<sup>3</sup>: “From internal experimentation to interenterprise business-to-business linkage, Web services are filtering into daily IT practice. 2003 is the year for even cautious enterprises to begin Web services pilots.”
- **Forrester Research**<sup>4</sup>: “Forrester Research believes that Web services will dramatically change the technology landscape, by enabling companies and individuals to use Internet middleware to unlock vast stores of data and to link and relate unconnected applications, services, devices, and even actuators,” said Ted Schadler of Forrester Research.

It is clear that Web services represent a fundamental shift in the way enterprises build and use IT systems and applications. These technologies can make it easier to link complex business systems, saving time and money while enabling these systems to respond more flexibly to business demands.

In order to take advantage of the benefits of Web services, business professionals must learn the basics — what Web services are, what they can do, and how they can change the way a company does business.

2. *Web Services Awareness and Adoption Study, 2002: Ready, Willing, But Able?*, IDC, Sandra Rogers, August 2002

3. *Web Services in Action*, Gartner, Inc. August 12, 2002

4. <http://www.dmreview.com/master.cfm?NavID=93&EdID=5397>, DMReview.com, April 1, 2003

## What are Web Services?

Web services are Internet technology-based, distributed software services running on a Web services architecture. These services enable users to discover and dynamically assemble different software components to create an application that delivers a desired service to the user — a service that is implementation and location independent as well as self-describing.

Using industry-standard protocols and technologies, Web services are expected to provide a new level of system-to-system automation in business and personal transactions. At a conceptual level, Web services support the notion that everything is a service, with a published API that can be utilized by other services or applications on the network. For example, a login service may provide user authentication functionality across multiple enterprise applications.

What makes Web services (and service-oriented architectures) unique is the distinct separation between the interface layer (how software components talk to one another) and the implementation layer (how software components are executed as code). Through commonly accepted eXtensible Markup Language (XML)-based interfaces instead of proprietary APIs, these services can then link together across or within enterprises using the XML data exchange standard. Once an application — or part of one — is exposed as a Web service, it can be used as part of other applications from that point on, without expensive customization or integration.

Web services technologies and APIs are based on open standards. Intended as an overlay to existing technologies, not as a replacement for them, Web services can use existing technologies to extend legacy systems into new applications and services — cost-effectively and efficiently. This means that Web services can help companies integrate disparate systems for less money than traditional methods.

For example, electronic data interchange (EDI) and enterprise application integration (EAI) solutions have helped companies exchange data for years, however, they lack flexibility and are costly to maintain. Forrester Research<sup>5</sup> estimates that Web services can expose information 10 to 100 times less expensively than EAI solutions. In the near term, Web services enable integration and process enhancement benefits more quickly and easily than either EAI or EDI methods. In short, Web services support what businesses want their IT investments to achieve — only faster.

Web services are part of the current trend in the application space — moving away from tightly coupled, monolithic systems and moving towards systems of loosely coupled, dynamically bound components. Systems built with these principles are expected to dominate the next generation of e-business, with flexibility being the significant characteristic of their success. Web services will enable applications that are based on compositions of services discovered and brought together dynamically at run time — in other words, just-in-time integration of services. As businesses move more of their existing IT applications to the Web, service integration becomes the driver of e-business, taking advantage of portals and e-marketplaces, and leveraging new technologies such as XML.

### **Benefits**

By providing a standardized interface for resources such as portals, the information and services they provide can be used by new applications, which helps streamline business processes. Silos of information or services are opened up, reducing duplication of effort. Integrating information and exposing data through standardized APIs means no vendor lock-in.

Web services can offer a number of benefits:

- **Lower Costs:** By increasing the focus on connectivity and reliance on manageable core services, reinvention and costs are reduced in a number of ways:
  - Web services employ an established, widely used presentation and transport technology — the Web — that does not need to be redesigned.
  - Based on standard protocols, Web services leverage existing deployment efforts. By using existing back-end systems and standardized protocols, integration efforts are reduced, both now and in the future.
  - Centralized deployment of services can lower total cost of ownership (TCO) by enabling central management of services by IT or external service providers.
  - Build or Buy: Standardized software components are becoming available, enabling IT operations to buy standardized components or use services provided by others. This enables “virtualized” processes, wherein key components of applications can be accessed as out sourced services. For example, an invoice shipper number directly connects users to the shipper’s Web site for transit information. These software modules are available from many shipping companies.
- **Improve Stability:** By utilizing proven components, Web services can help deliver higher uptime and a stable platform for rapidly deploying new services.
- **Increase Agility:** By reducing the time and effort to create and deploy new services, an organization’s agility is improved. Applications can be continually adapted to match new business processes.
- **Improve Customer Satisfaction:** Web services offer improved customer service and product information capabilities with faster response time.
- **Use Technology As a Strategic Weapon:** IT operations can expose a variety of services and enterprise application resources to the Web. Businesses can build tighter relationships with customers, partners, and suppliers, while accumulating valuable transaction information.
- **Reduce Time to Market:** New business logic can be delivered more quickly because developers are freed from complex integration tasks, decreasing development and testing time.
- **Improve Security:** By providing a structured and consistent framework for applications, security is enhanced and a more uniform deployment policy can be enabled. This can also improve the integrity of messaging and transactions.

### **Core Web Services Technologies**

Web services depend on the ability of various systems to communicate with each other, even if they are using different information systems. XML is a key technology in addressing this need. Enterprises have discovered the benefits of using XML for the integration of data, internally for sharing legacy data among departments, and externally for sharing data with other enterprises.

**Get the details.**

Based on the Java programming language, Java technologies have been at the center of Web development for many years — from back-end servers to consumer devices. Java APIs, products, and technologies create an open, standard, and comprehensive environment for developing and deploying Web services.

As a result, XML is increasingly being used for enterprise integration applications, and is a key underpinning for Web-related computing.

In addition to mature Web protocols — HTTP, HTML, and SSL — a number of technologies have broad industry support. Other standards being used to create Web services include:

- **Messaging:** The Simple Object Access Protocol (SOAP) provides a simple and lightweight mechanism for exchanging structured and typed information between peers in a decentralized, distributed environment using XML. SOAP makes it possible to use Web services for transactions, for example, checking inventory in real time and placing an order. SOAP enables Web services to operate through corporate firewalls using transport protocols such as HTTP and SMTP.
- **Service Description:** The Web Services Description Language (WSDL) is an XML format that describes the Web service and how to use it. WSDL is extensible to many message formats and network protocols.
- **Service Discovery:** Universal Description, Discovery, and Integration (UDDI) is a specification for distributed, Web-based information registries of Web services — telephone books for Web services. UDDI is also a publicly or privately accessible set of implementations of the specification that enables businesses to register information about the Web services they offer so that other businesses can find them.
- **Electronic Business:** Electronic business XML (ebXML) is a global effort to standardize the exchange of business data while coordinating business processes. It is an enabling framework for the future of business-to-business (B2B) Web services.

*Java™ Technologies*

Because Web services depend on the ability of enterprises using different computing platforms to communicate with each other, the Java™ platform is the natural choice for developing Web services. Java technology makes code portable by decoupling the operating system from the application logic. Based on the Java programming language, Java technologies have been at the center of Web development for many years — from back-end servers to consumer devices. Java APIs, products, and technologies create an open, standard, and comprehensive environment for developing and deploying Web services. This choice is even more attractive — the new Java APIs for XML make it easier to use XML with the Java programming language.

In addition to data portability and code portability, Web services must be scalable, secure, and efficient, especially as they grow. Java 2 Platform, Enterprise Edition (J2EE™) technology is specifically designed to meet these requirements. The J2EE platform facilitates infrastructure programming, a significant part of any enterprise application deployment. This infrastructure includes features such as security, distributed transaction management, and connection pool management, all of which are essential for industrial-strength Web services. The flexibility and scalability of J2EE technology has made it the platform of choice for building multitiered enterprise applications. Because XML and the Java platform work so well together, they have come to play a central role in Web services. In fact, the advantages offered by the Java APIs for XML and the J2EE platform make them the ideal combination for deploying Web services.

## Who's Using Web Services?

Web services are real. Today, many well-known companies are using XML, Java, and J2EE technologies to save money and leverage the IT infrastructure within their enterprises. This section examines a few examples.

### Life Time Fitness

The Life Time Fitness<sup>6</sup> company operates a chain of 23 “sports resorts” in Illinois, Indiana, Michigan, Minnesota, Ohio, and Washington, D.C. Web services integrate Life Time’s public Web site and private intranet with an online scheduling system from Xtime, an application service provider. As a result, Life Time’s 300,000 members can use its site to book health club facilities and services, including massages, personal trainers, and racquetball courts. This customer self-service capability saves employees’ time. Employees can also utilize the same system through Life Time’s intranet.

### Business Impact

Web services have the potential to change the way companies add value — and make money — in the market. Just as Web services will lower the boundaries between applications inside today’s enterprise, they will also remove the barriers between organizations tomorrow. Consider that today many companies operate with virtual teams — employees, partners, and suppliers — working from virtual offices. Web services have the capability to extend this trend, with the potential to impact the way a company does business.

- **Speed:** Web services enable businesses to create new applications more quickly. These applications and services can help businesses target and exploit new opportunities. Sales, production, accounting, marketing, engineering, and executive management will have more visibility into what they need to be more effective. Web services have the ability to help shorten planning, production, forecast, and sales cycles. In effect, the speed of business will accelerate more quickly.
- **Commoditization:** Virtually anything that is created within IT can be easily replicated and made portable. At many companies, Web services will drive hard questions about IT core competencies — what to build and what to buy — accelerating a process that is destined to become virtualized. For example, billing, customer relationship management, and inventory control applications are expected to be outsourced in much the same way as payroll and HR applications are today. It is expected that it will be easier and less expensive to use applications from service providers rather than those developed in-house.
- **Transactional Transparency:** Web services are expected to increase visibility into a company’s customer base. The organizations that leverage value chain data by building products and services around this knowledge can derive a competitive advantage. Business managers and executives will need to constantly evaluate how to productize the relationship with their customers.

What should business managers and executives do to prepare for these possible changes? First, begin to analyze the enterprise core competencies — talent, capabilities, customer profiles, supplier relationships, development and production expertise, and so on. Then, take a hard look at the market and competitive landscape to identify trends that seem to be emerging, other companies that represent a threat, and new technologies or initiatives that are making inroads. After careful study and analysis, make plans according to what you’ve learned.

6. <http://java.sun.com/features/2001/08/life.html>, Sun Microsystems, August 10, 2001

### What's the Future?

Previous attempts at distributed computing, including CORBA, were never optimized for a distributed architecture such as the Internet. While CORBA can be used to create links between businesses, it represents a tightly coupled architecture that requires significant effort to set up or change. Technologies such as DCOM and CORBA require too much agreement and shared context among business systems from different organizations to be widely used.

Just as Web services are being used today to integrate applications within an enterprise, they can be used to interoperate with other organizations outside the firewall. Unfortunately, there are challenges in the available technologies that prevent widespread adoption of Web services as a B2B infrastructure. Consider that the IT infrastructure of virtually any business is a unique combination of applications, business processes, and systems. Enabling companies to discover, negotiate, and transact business using Web services requires a new level of technology (to ensure reliable delivery of messages between organizations, for example); a standard way to communicate (agreement as to what “purchase order” means and the steps required to execute one, and so on); as well as security to ensure the privacy of all communications.

#### *ebXML*

Web services, as they are being developed and deployed today, are primarily focused on application-to-application (A2A) integration. Using the same technologies and protocols, they can be extended in the future to provide business-to-business (B2B) services as well. ebXML is designed to enable a global electronic marketplace in which enterprises of any size can safely transact business through the exchange of XML-based messages. This is accomplished by developing a single set of internationally agreed-upon specifications.

A complete B2B framework, ebXML enables collaboration through the sharing of Web-based services. It supports the definition and execution of B2B processes expressed as choreographed sequences of service exchanges. Transports used to send XML messages between enterprises may utilize SOAP (or extensions to SOAP) provided by ebXML. The ebXML messaging transport enables a message to be sent securely and reliably.

Because ebXML differs from historical techniques such as proprietary EDI solutions in many ways, it will deliver promised benefits and reduced costs beyond that achieved by previous solutions. Proprietary EDI solutions are extremely expensive due to high-cost licenses, custom development, lengthy implementation cycles, and the use of proprietary, value-added networks (VANs). EDI solutions typically depend on proprietary transport layers, are not Internet friendly, and are rarely based on standards. These characteristics preclude the ability to leverage EDI solutions and IT knowledge across the enterprise. In addition, vendor lock-in is common with proprietary EDI solutions, leaving few options for switching technology or vendors later as the industry evolves.

### The Home Depot

The world's largest home improvement retailer — The Home Depot — has embarked on a series of IT initiatives based on Web services. Their strategy calls for using XML for defining data to be shared between applications, and Web services for breaking up monolithic applications into reusable components. The Home Depot's existing point-of-sale environment is highly customized and tightly coupled with multiple store systems, including tool rental and special orders. It works well, but the company found it difficult to tailor its system to respond to business changes. According to The Home Depot, the simplicity and flexibility of XML helps reduce integration costs and development time, even when linking legacy systems. Because the data format is so simple, employees can go to a mainframe COBOL application, generate an XML document, and ship it out over the wire.

In one initiative, The Home Depot<sup>7</sup> wanted to create a Web interface to track orders of custom window blinds. Because the business logic in the legacy version of this application worked well, the company did not want to change the existing mainframe system. So order processing tasks were kept on the mainframe and XML documents were used to send completed transaction data to a Web-accessible repository. Every store could easily answer customer inquiries regarding the status of their orders. According to The Home Depot, Web services are fast, scalable, and flexible.

7. <http://industry.java.sun.com/javaneWS/stories/story2/0,1072,42081,00.html>, Sun Microsystems, January 24, 2002 and [http://www.nwfusion.com/news/2002/129295\\_01-21-2002.html](http://www.nwfusion.com/news/2002/129295_01-21-2002.html), Network World, Ann Bednarz, January 21, 2002

### General Motors

General Motors Corp.<sup>8</sup> is already committed to using the Internet to routinely connect with employees, suppliers, and customers using Web services. In March 2002, the auto maker launched far-reaching Web services tests that are expected to enable workers to freely access GM's vast stores of data via the company's 130,000-seat Lotus Notes installation.

And that's just the beginning. Chief Technology Officer Tony Scott says that Web services standards will ultimately enable GM to create marketing partnerships in order to deliver new services. Behind his enthusiasm is the fact that any application incorporating Web services standards — SOAP, WSDL, UDDI, and XML — can automatically discover and connect with any other Web services.

ebXML provides support for the fundamentals of B2B transactions, including:

- **Reliable Messaging:** Ensuring that messages sent between enterprises are delivered.
- **Nonrepudiation:** Ensuring that a business cannot accept a transaction, only to reject it later.
- **Long-Running Transactions:** Providing the ability to undertake transactions that may require hours, or even days, to complete.
- **Process Choreography:** A framework that executes transactions according to the requirements of an enterprise's business processes. For example, that a payment is accepted, approved, and disbursed according to a business's unique requirements.
- **Explicit/negotiated agreement of processes and connectivity.**
- **Common Business Semantics:** Industrywide agreement on terms required to do business. For example, standard definitions of "purchase order," "invoice," "stock check," and so on.

The ebXML initiative has set out to establish an XML-based electronic business infrastructure as a modular suite of specifications. Many implementations are available today. In fact, some of these specifications have been adopted by important industries such as travel, healthcare, and more. Work on these standards is being continued by the Organization for the Advancement of Structured Information Standards (OASIS).

An important specification is the Universal Business Language (UBL), which is developing a library of standard XML business documents:

- **Health Level 7 (HL7)** is oriented toward the healthcare industry. The not-for-profit Health Level Seven, Inc. is an ANSI-accredited, standards-developing organization dedicated to providing a comprehensive framework and related standards for the exchange, integration, sharing, and retrieval of electronic health information that supports clinical practice and the management, delivery, and evaluation of health services.
- **Standards for Technology in Automotive Retail (STAR)** is oriented toward the automotive industry. This nonprofit, industrywide initiative is working to define the standard XML message for dealer-to-OEM business transactions, such as parts order, sales lead, credit application, and so on. It is also working to define a standard IT infrastructure (ebXML) to support messages between dealers and OEMs.
- **The OpenTravel Alliance (OTA)** is working to standardize information in message exchanges for the travel industry.
- **The Chemical Industry Data Exchange (CDIX)** is providing standardized messages and document data types (DTDs) for the chemical industry.

8. <http://www.informationweek.com/story/IWK20020315S0027>, InformationWeek.com, Paul McDougall, March 18, 2002

The term service-oriented architecture (SOA) takes existing software components residing on the network and enables them to be published, invoked, and discovered by each other.

#### Service-Oriented Architectures

The ultimate goal for Web services is to create an environment where any business resource or information is available to any requestor. Accessing services through a common set of standard protocols and APIs, services are deployed only once and are universally available. They are self-describing and self-contained, performing specific business functions within the enterprise or with partners, customers, and suppliers. The term service-oriented architecture (SOA) is used to describe such an infrastructure.

SOA takes existing software components residing on the network and enables them to be published, invoked, and discovered by each other. Furthermore, SOA employs services that developers create in a service layer. These services have published interfaces that support distinct business domains. Organizations that focus their development efforts around the creation of services will realize many benefits. Most development organizations have some experience with component-based development. The use of application servers, such as those based on the J2EE platform, for hosting applications is becoming more common.

With SOAs in place, new applications are no longer developed from scratch. Instead, applications can be created from a set of services published within the enterprise or by service providers, while available services are managed through a central registry. ebXML is an enabling technology for this infrastructure because it works with all existing Web services technologies.

#### Merrill Lynch

On December 6, 2002, InfoWorld<sup>9</sup> reported that Merrill Lynch, one of the world's leading financial management and advisory companies with offices in 36 countries and total client assets of approximately \$1.3 trillion, is embracing Web services technologies. Merrill Lynch spent \$30,000 on a project exposing legacy systems as Web services, saving \$700,000. At the time of the article, the company stated that it had 14 applications in production inside the company utilizing Web services, and another 18 to 20 Web services applications in the planning stages. John McKinley, CTO, stated: "If you have a project up for review that you need to defend, you need to explain why you don't need to implement it as a Web service."

9. [http://www.infoworld.com/article/02/12/06/021209cttop14\\_1.html](http://www.infoworld.com/article/02/12/06/021209cttop14_1.html), InfoWorld.com, John McKinley, December 06, 2002

**Solutions built on security standards address problems related to authentication, role-based access control, guaranteed message delivery, and data integrity.**

## Security Considerations

Security is an important architectural aspect of any enterprise application. Most large organizations maintain numerous relationships with suppliers, vendors, partners, dealers, and customers. A variety of agreements provide a defined, yet unique set of roles, permissions, and responsibilities for different companies and users as they interact with an enterprise. Electronic commerce systems must provide the same capabilities, while protecting both systems and communications. Solutions built on security standards address problems related to authentication, role-based access control, guaranteed message delivery, and data integrity.

Lack of security standards for B2B transaction infrastructures is a significant near-term obstacle to widespread deployment. While some enterprises are developing B2B relationships based on Web services, security is typically configured on a one-to-one relationship — impractical for an industrywide deployment. Various organizations are working on standards and specifications for process flows and security protection that are required to achieve this integration.

Standards and specifications under development include:

- **XML Signature:** A standard that allows XML documents to be signed digitally.
- **XML Encryption:** An encryption standard for Web services.
- **Security Assertion Markup Language (SAML):** A standard for sharing information securely between different corporate access and authentication systems of trading partners.
- **eXtensible Access Control Markup Language (XACML):** A specification for expressing policies for information access over the Internet.
- **The Liberty Alliance Project:** A group working to enable a networked world in which individuals and businesses can more easily conduct transactions, while protecting the privacy and security of vital identity information.

**Get the details.**

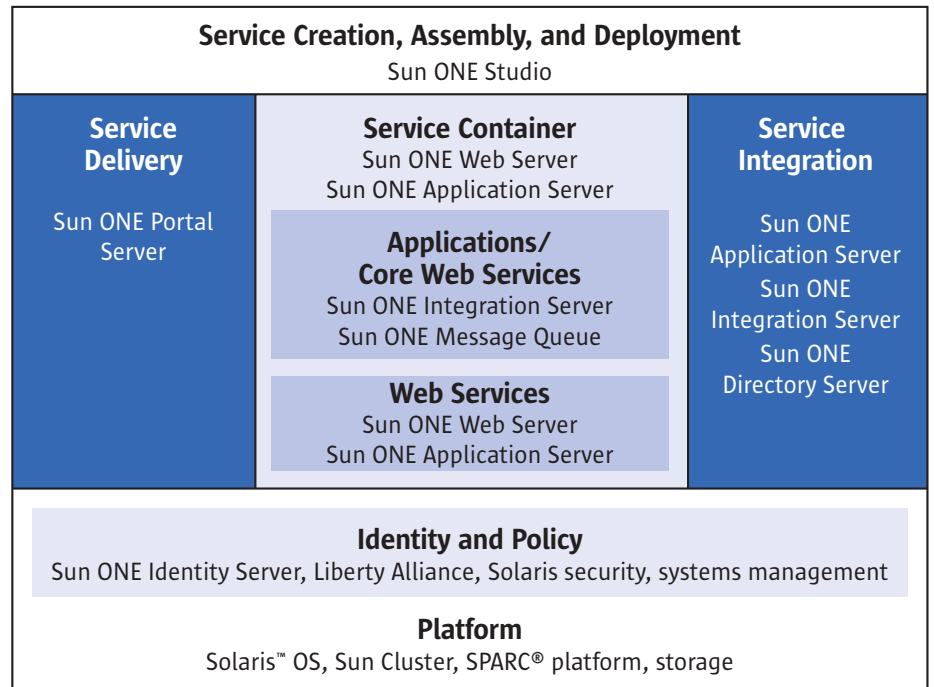
The Sun ONE architecture is an integratable stack, based on open standards, APIs, and protocols. It is designed to integrate and extend existing IT infrastructures, leveraging available resources.

## Sun Delivers Web Services — Today and Tomorrow

Sun has been one of the leaders in distributed computing since its inception. The company has made a corporate commitment to being a leader in Web services through its participation in standards committees, ongoing evolution of the Java 2 Platform, network hardware and software expertise, and its extensive business partner network. In fact, today Sun and its various partners are designing and supporting sophisticated Web services implementation.

As part of an ongoing effort to enable enterprises to leverage Internet technologies into their IT infrastructures, Sun created the Sun™ Open Net Environment (Sun ONE). The Sun ONE architecture is an integratable stack, based on open standards, APIs, and protocols. It is strongly aligned to standard Web interfaces, bases its interoperability strategy on them, and is designed to integrate and extend existing IT infrastructures, leveraging available resources. As an open, end-to-end architecture, the Sun ONE platform enables customers to support existing application needs while building a solid foundation for Web services. The Sun ONE architecture is:

- **Integratable:** Sun ONE connects and integrates with existing systems. Businesses are free to use existing components anywhere in the Sun ONE framework.
- **Complete:** A comprehensive platform, Sun ONE includes the tools, products, and technologies to create, assemble, and deploy Web services.
- **Standards-based:** Sun ONE is designed to support major standards initiatives such as SOAP, J2EE, UDDI, LDAP, and ebXML, enabling developers to take advantage of Web services now and in the future.
- **Evolving:** Many key elements are still being defined in standards bodies, and Sun is playing a major role in shaping them. Adding new capabilities is an evolutionary — not revolutionary — process because businesses build on their existing assets. This protects current technology investments.



The Sun ONE Platform

The Sun ONE platform is the basis for scalable, reliable, and open standards-based Web services. The architecture encompasses:

- Operating system (OS), hardware, storage, and networking platforms, including the directory technology necessary to define users, subscribers, organizations, and policy.
- Presentation, business logic, and data access:
  - Service Delivery is the presentation layer. In this architecture, the portal server delivers services to any device, aggregating content and providing security, personalization, and knowledge management.
  - The Service Container, which provides business logic (where the Web services run), is typically a J2EE application server. The Service Container can contain prebuilt Web services that an enterprise may build or buy, often hosted by an existing commerce or communications application.
  - Service Integration is the data access layer. It integrates enterprise assets such as EDI and EAI applications, legacy applications, and database repositories.
- Tools for creating, assembling, deploying, and testing services.

The Sun ONE platform offers several features that decrease time to market in a unique fashion. Many of these features are especially relevant to developers whose job it is to create the low-level details of their enterprise's high-level plan.

J2EE technology is platform-agnostic, running on a variety of hardware platforms and operating systems, such as Microsoft Windows, UNIX®, and mainframe systems. This portability is real today because the Java Runtime Environment (JRE), on which J2EE technology is based, is available on virtually any platform. Sun has built a J2EE technology compatibility test suite to ensure that J2EE platforms comply with the standards. This test suite is critical because it also ensures portability of applications. Adding Web services standards and protocols, such as XML and SOAP, extends this portability even further.

Creating versatile Web services requires more than just the right technology. Sun can help you make well-informed decisions about which pieces of your business are a good fit with the design philosophy of Web services. Once your objectives are well understood, Sun can help you apply an IT strategy and architectural design to meet your business goals. Sun offers many resources that can help organizations embrace Web services in a way that makes sense for their business. These include:

#### *Leverage Sun Services to Maximize Quality of Service (QoS) and Return On Investment (ROI)*

Sun Services can help maximize QoS and ROI as you architect, implement, and manage your Web services solution. Experienced Sun consultants can enable you to meet the demands of architecting and implementing Sun ONE platform-based software solutions — tailored to your business and technical requirements — for long-term success. To better assist you, Sun consultants employ field-tested SunTone<sup>SM</sup> Architecture Methodology, repeatable design patterns, and proven best practices.

Creating versatile Web services requires more than just the right technology. Your IT staff will also benefit from an in-depth understanding of the technology and skills required to implement Web services in your enterprise. Sun offers up-to-the-minute courseware and comprehensive support to help develop, integrate, and deploy Web services. And, as your Web services solution moves into production, Sun can help your organization achieve reliable performance and maximize ROI through system and software support and ongoing training.

#### *iForce<sup>SM</sup> Initiative*

Sun's iForce<sup>SM</sup> initiative brings together Sun and its global industry partners to deliver proven solutions designed to help customers — ranging from startups to large enterprises — harness the power of the Internet and drive business advantage. iForce solutions differ from competitive, single-company offerings because the iForce community provides a rich array of products, programs, and services.

iForce Ready Centers, located around the world, assist Sun customers with everything from brainstorming technological options for creating and IT infrastructure, to proof-of-concept demonstrations, to actual pilot programs. An iForce solution is a pretested aggregation of best-of-breed applications that is scalable, customizable, and adheres to open standards.

**Get the details.**

**N1 takes the first “systems” approach to data center design by building an integrated system that includes the network, compute, and storage elements necessary to deliver a complete business service.**

*SunTone Program*

To provide customers with a means for identifying high-quality sources for Web-based services, Sun established the SunTone Certification and Branding program. These documented standards for excellence provide guidelines for architecting and operating required levels of service. SunTone certification can be applied to all aspects of a Web service, including infrastructure, service provider, applications, security, and management practices. The SunTone Architecture Methodology is based on many years of experience designing and delivering Internet-based business solutions for thousands of customers across all industries. The SunTone program promotes progress toward reaching the Webtone — available, reliable Web services.

*Sun N1*

Web services, and the distribution of services to the edge of the network, are expected to increase the complexity of IT infrastructure. Systems, interfaces, and processes can easily proliferate, overwhelming today’s network management platforms. In an effort to create an easier management interface, N1 represents Sun’s vision, architecture, and products for making entire data centers appear as one system. It is the primary lens through which Sun will focus and drive a variety of activities in the company for the next generation of products and services. N1 takes the first “systems” approach to data center design by building an integrated system that includes the network, compute, and storage elements necessary to deliver a complete business service, such as e-banking. Products supporting N1 were released in February 2003.

Through dynamic allocation and reallocation of resources between services, N1 helps assure the right amount of IT resources, in the right place, at the right time, to meet the demands of a dynamic business. In doing so, N1 allows service operation and management to be more aligned with business needs.

# N1 represents Sun's vision, architecture, and products for making entire data centers appear as one system.

The goal for N1 is to virtualize the resources of a data center into a single system that enables simpler management, better efficiency, and flexibility. N1 is designed to:

- Virtualize the physical infrastructure, including the storage, network, CPU, and memory resources that a business service, such as e-banking, requires.
- Provision the software stack on top of the virtualized resources by automatically installing and configuring the software elements necessary to deliver a service.
- Dynamically allocate (add or subtract) the necessary resources to maintain a consistent service level.
- Maintain detailed accounting records on a per-business-service basis.

The N1 architecture can offer a number of benefits, such as:

- Reduce the overall costs of deploying and managing services by reducing management complexity.
- Deploy new, additional services with existing resources: Shared, dynamic access to excess capacity means more services can be deployed on existing services without compromising the customer's quality of experience.
- Increase business agility: Automatically and dynamically adjust IT resources to changing business demands, and implement new services to address new markets more rapidly.
- Reduce financial risk: The ability to implement utility-based billing and expense models means that customers pay only for what they actually use, and incur expenses only as they grow revenue, while maintaining the ability to accommodate unexpected changes in demand (up or down).
- Easily determine service return on investment (ROI) and return on assets (ROA): Detailed accounting of resource consumption on a per-service basis permits explicit analysis of the costs associated with providing each service.

### Getting Ready for Web Services — Next Steps

Web services can be the heart of your business's profitability and competitiveness. Although deploying them is a long-term effort, Web services can also return many short-term benefits, while providing a smooth, clear path to a computing platform that will serve the organization for years to come. As your IT organization evaluates ways in which Web services can improve productivity, save costs, and create new opportunities, consider the following:

- *Determine enterprise core competencies.* What resources need to be developed and maintained in house, and what can be purchased as an outside service? Where does the enterprise have a competitive edge in the market place? How can IT be used to enhance this edge, and what resources must be applied?
- *Develop an architectural plan for rolling out Web services in your organization.* Be sure to consider existing infrastructure and interfaces (both internal and external, if any). Architect for general use — if a service is a success, users will want to access it from wherever they are, using many different applications. The strategy should also define policies. One of the more difficult tasks in creating Web services is determining the rules for using them.
- *Begin a pilot program to gain an understanding of Web services, including technologies and standards initiatives.*
- *Perform a follow-up analysis of how well the pilot project performed.* Gather input from all affected groups, including development, IT, service, and customers. Did the pilot project meet established goals and performance metrics? Where could the project have been improved? Identify other areas where Web services could add value.
- *Begin to follow what is happening in the industry with respect to Web services.* What are the relevant standards and government regulations? Who is successfully implementing Web services? What are the best practices? By becoming more knowledgeable about Web services, you can make better decisions about implementing them in your business.

Sun Services can provide assistance and expertise for many of the above steps. For more information, visit [sun.com/service](http://sun.com/service).

### For More Information

Web services are not just the way of the future; they're here right now. And the key to success for most organizations will be how well they design a strategy that employs the latest standards, technologies, and products to create Web services, and implement on that strategy.

Sun offers a wide array of technologies and products, based on open industry standards, as well as a complete range of services to support your Web services initiatives. To learn more about Sun's offerings, please visit [sun.com/software](http://sun.com/software).

### Sun Executive Boardroom Program

If you're interested in participating in discussions on how to use the network to reduce costs, grow your business faster, and gain competitive advantage, then Sun's Executive Boardroom Program is right for you.

Designed specifically for business executives, the Sun Executive Boardroom Program provides a forum where leaders can share how technology affects their organizations. By participating, you'll receive a monthly newsletter and third-party reports, and be able to dialogue with the Sun management team and some of Sun's top executives.

Seize this unique opportunity to learn and share valuable information. Register to join the Sun Executive Boardroom Program today at [sun.com/boardroom](http://sun.com/boardroom).

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Would you like to get the inside story on the trends and technologies shaping the future of systems and network management — before your competitors do? Then sign up for Sun's Inner Circle Program.

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