

Oracle Fusion
Architecture
Eases the
Adoption
of Service-
Oriented
Architecture

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Oracle Fusion Architecture Eases the Adoption of Service-Oriented Architecture

During the past few years, a confluence of IT customers' pressing technical and business requirements and the availability of new technical capabilities has set the stage for the next generation of business computing. Summit Strategies labels this generation as one of "dynamic computing," and broadly characterizes it as an era in which IT resources become more automated, more agile and—most important—more synchronized with the business processes and objectives that the resources support. Dynamic computing and the business agility it promises, in turn, depends on various building-block tools and technologies. None of these enablers is more important or wide-reaching than that of service-oriented architecture (SOA).

In SOA deployments, software applications and business processes are presented as collections of standards-based components (or "services") that each perform a discrete function. The self-contained services are loosely coupled and designed to be called into use in a message-based, event-driven fashion, rather than being tightly coupled and hard coded to function in a synchronous, guaranteed-available mode (although SOA services can be configured to execute synchronously, if desired). The services themselves can either be built from scratch, or be created by wrapping existing business logic and exposing it via standard interfaces.

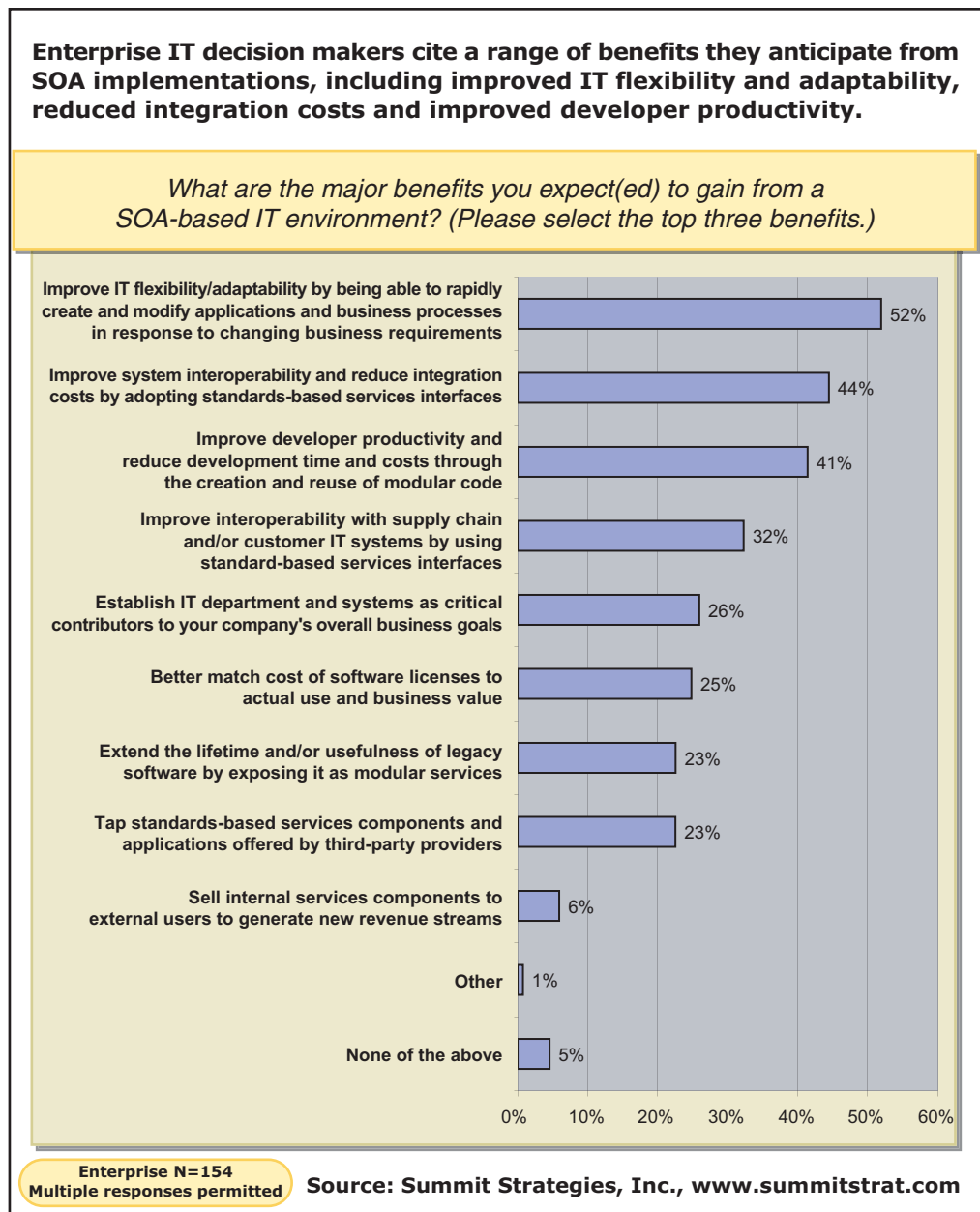
Service orientation has existed in IT environments for many years, but only in proprietary forms until recently. The emergence of key standards, particularly the XML-based collection of Web services specifications, has catalyzed the creation of common SOA environments that can easily interact with one another. Standardized SOA, in turn is generating excitement among IT and business executives because it holds the potential to solve a range of technical and business problems that currently bedevil most companies.

Ultimately, SOA offers enterprise computing users a means to escape from the inflexible and incompatible collections of IT systems and applications that most companies have accumulated over many years. The difficulty and cost of getting such systems and software to interoperate, not to mention the challenges of modifying them to adapt to changing business requirements, have overwhelmed IT budgets and held back innovation. SOA lowers the interoperability hurdles and

converts monolithic and static systems into modular and flexible components. As a result, corporate IT groups can focus on supporting the ever-changing business needs of its company, rather than spending all its time and money just keeping a cobbled-together computing environment limping along.

A September 2005 survey of enterprise IT decision makers conducted by Summit Strategies identified the key benefits that these users expect SOA to deliver. Leading the list of anticipated benefits is the improved IT flexibility and adaptability that SOA can provide (see Figure 1).

Figure 1 Benefits of Implementing a SOA-Based IT Environment



Despite SOA's promise, many companies remain uncertain about the relevance of SOA to their specific needs, or unclear about how to evolve to this new form of computing in an intelligent and manageable fashion. The good news for these customers is that the core SOA concepts are relatively easy to grasp, as is the technology's potential for easing their most pressing pain points. Furthermore, users can move to SOA incrementally, and can often start by extending and enhancing the value of their existing systems and software.

Not surprisingly, SOA has become a primary theme for all of the leading infrastructure and applications software vendors, and increasingly serves as a unifying architecture under which they align their products and go-to-market messaging. One of the most committed and advanced of these vendors is Oracle, as we detail in this paper.

We begin the paper by reviewing core concepts and functionality associated with SOA as well as with the closely related and synergistic event-driven architecture (EDA). Next we explain how SOA's ability to address customer pain points is fueling customer adoption of this form of computing. We then examine the role SOA plays in Oracle's overarching Fusion Architecture as well as the overall Oracle Fusion initiative, followed by a drill-down into the core elements of Fusion Middleware as they exist today, and into the directions Oracle intends to take its software portfolio. The paper concludes with a discussion of how companies can initiate SOA-adoption efforts, and why they should do so sooner rather than later if they hope to remain competitive and want to realize the full benefits of this compelling computing model.

Section 1 SOA Leverages Software Standardization and Business Events

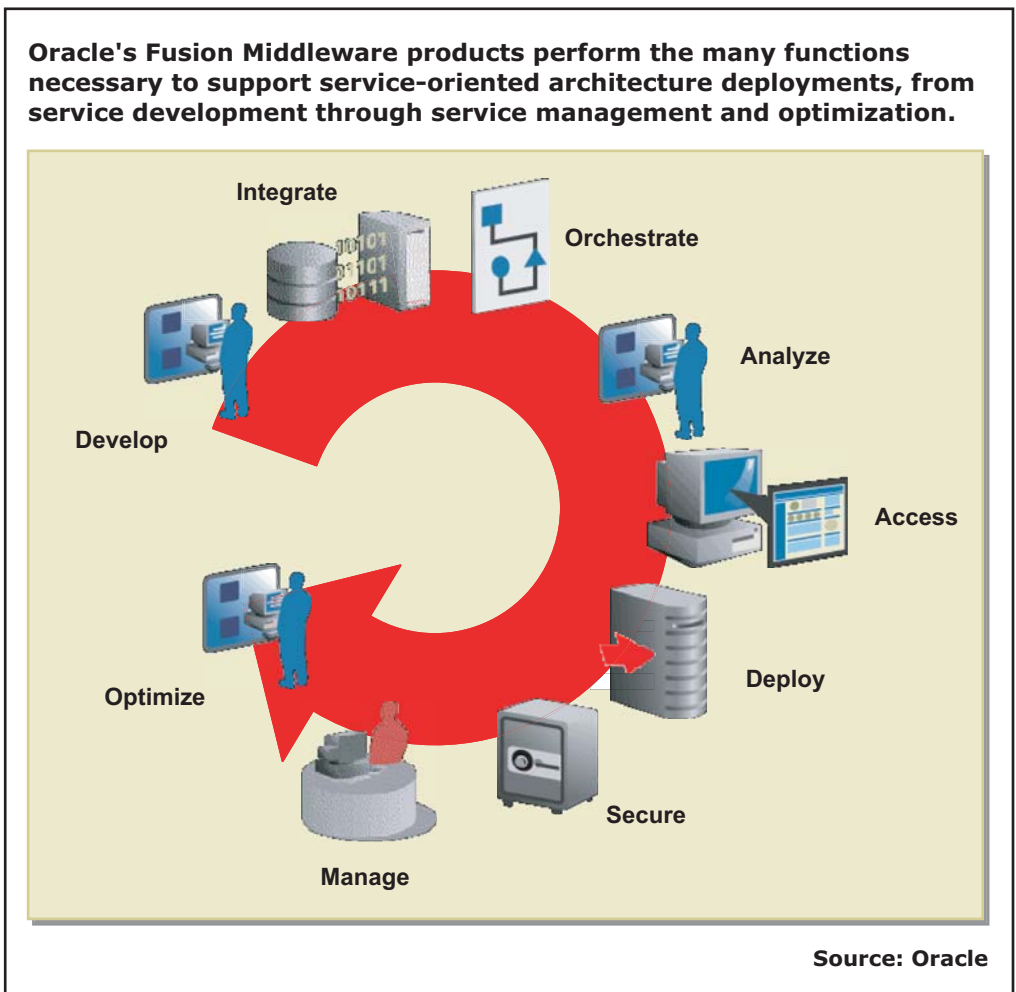
Inevitably, SOA's very name causes people to focus on the "services" aspect of the technology. And, indeed, much of SOA's power derives from its ability to leverage standards-based functional services, calling them when needed on an individual basis, or aggregating them to create composite applications or multi-stage business processes. The building-block services can be stored and reused, and can also be updated or replaced without affecting the functionality or integrity of other independent services. In this latter regard, the services model offers big advantages over large monolithic applications, in which modifications to some portions of the code can have unintended and unpredictable effects on the rest of the code to which it's tightly bundled.

Beyond the services aspect, however, SOA also requires another fundamental technology if it is to realize its full potential: event-driven computing. Ultimately, key goal of most SOA implementations will be to automate as much processing as possible and desirable, and to provide critical and actionable information to people when they must play a role in a workflow process. Realizing these goals will require the computing infrastructure itself to recognize meaningful events and respond to them appropriately—either by automatically initiating new services and processes or by notifying users of the events, putting them into context and, often, suggesting the best courses of action. This broad capa-

bility is sometimes referred to as an event-driven architecture, which goes hand in hand with a services-oriented architecture. For the purposes of this paper, we generally use the overarching “SOA” label to encompass both the service-oriented and event-driven elements of this trend.

Although SOA is typically positioned within the realm of middleware and other infrastructure software, the architecture inherently encompasses the application software tier as well. SOA’s effect on both middleware and applications has facilitated a trend underway for several years—the migration of certain functionality from the application tier to the infrastructure tier. In the past, many enterprise applications have been largely self-contained environments that included their own proprietary security models, analytic and reporting tools, data stores, business processes, and so forth. For some time, though, we’ve seen the movement of much of this horizontal functionality into the middleware tier, where it can be instantiated in a standard fashion and applied to all the business logic and processes flowing within the application/services tier. Oracle, with a portfolio that

Figure 2 Service Oriented Lifecycle



encompasses both infrastructure software and enterprise applications is able to leverage and synchronize both of these software tiers.

Meanwhile, the infrastructure software that supports these modular services must perform a variety of tasks. These include registering and storing the services, routing and transforming them, combining them into composite applications or multi-step business processes, securing them, and a number of other functions. Some vendors offer middleware products that perform specific jobs within this arena, while others, including Oracle with its Fusion Middleware, offer full-spectrum software suites that perform all of the core SOA infrastructure functions in a consistent and integrated way. (See Figure 2 for Oracle's depiction of the main stages and functions within the "service oriented lifecycle.")

Section 2 Escalating IT and Business Demands Drive SOA Adoption

As recently as 2004, there was still significant debate about the benefits that SOA could deliver and, more important, about the willingness of customers to migrate to this new architecture. However, various customer surveys, including Summit Strategies' September 2005 survey of enterprise IT decision makers, have demonstrated that SOA is well on its way to broad adoption. Figure 3 depicts data from our survey showing enterprise customers' adoption and future plans for a number of dynamic computing technology enablers, including Web services and SOA. As shown, almost three-quarters of the enterprises responding to our survey indicated they have already deployed Web services in general use, limited use or pilot initiatives, and close to one-half say the same about SOA.

The companies already moving down the SOA path are doing so for many different reasons that are specific to their own business situations. Unifying all of the discrete SOA drivers, however, is a fundamental need that companies have to improve IT flexibility and adaptability in order to better support key business requirements. Beneath this overarching objective are a range of common challenges, many tied to the internal complexity and rigidity of the typical corporate IT environment. This complexity and inflexibility drives up development, integration and maintenance costs and limits IT's ability to rapidly respond to changing business opportunities and threats.

Collectively, companies have spent many billions of dollars to integrate their assortment of proprietary platforms and applications, and also to maintain and extend monolithic applications that often reside in their own, walled-off functional silos. IT departments have had to provide interoperability among different data formats, different application interfaces, different message routing systems, different security systems, and a long list of other technical disconnects.

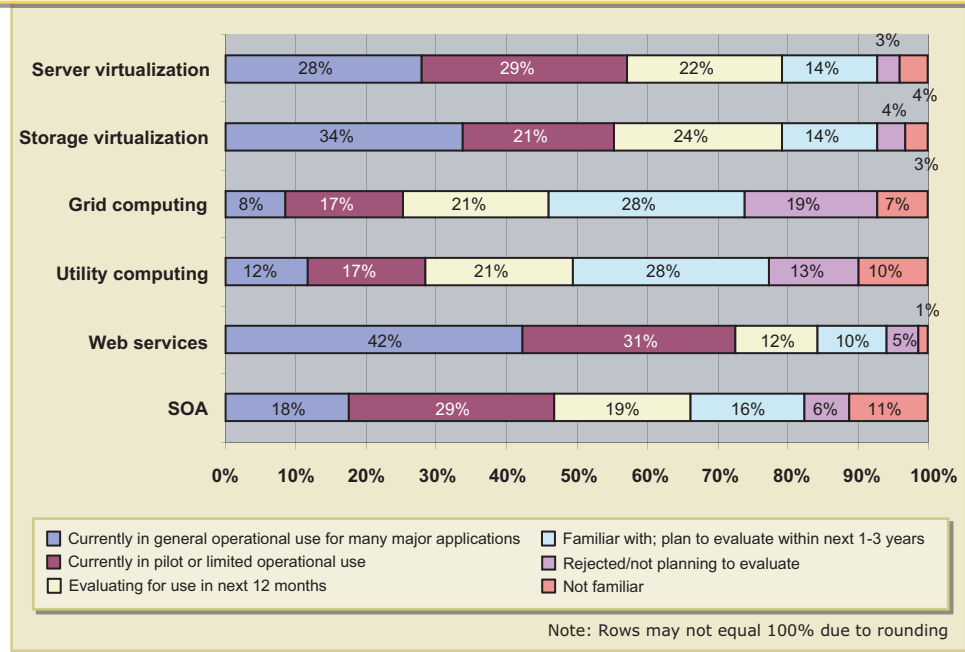
It was possible, if expensive, to custom code point-to-point integrations of all these elements when working within the bounded realm of a single company's internal IT infrastructure. In the age of the Internet, it quickly became impractical to apply the custom approach when dealing with dozens of suppliers and partners or with hundreds, thousands or millions of Web-based customers and their IT systems.

Figure 3

Infrastructure Software Awareness and Adoption

A September 2005 Summit Strategies survey of enterprise IT decision makers indicates that many are moving to deploy Web service-based solutions, and close to one-half have already deployed SOA in general use, limited use or pilot initiatives.

Which statement best describes your organization's current awareness and strategy regarding the following infrastructure technologies?



Enterprise N=154

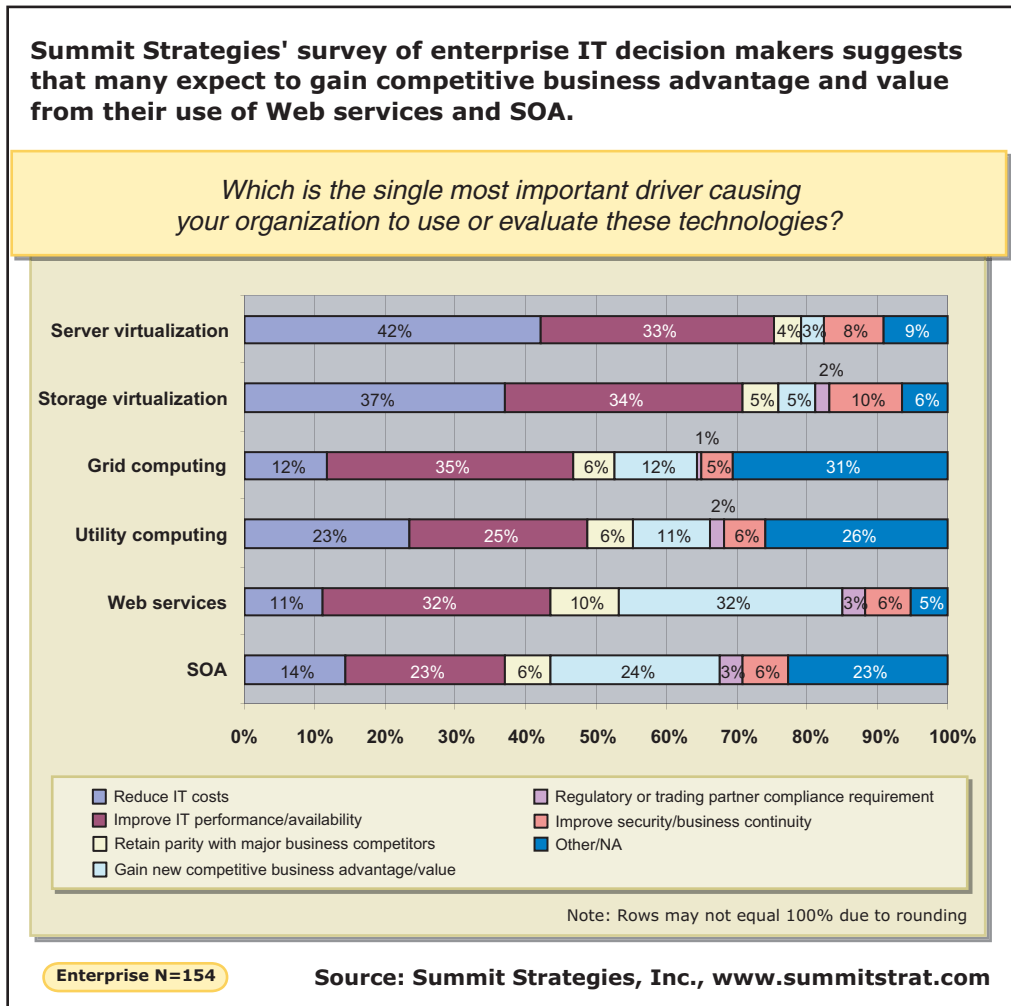
Source: Summit Strategies, Inc., www.summitstrat.com

The only practical solution to this escalating complexity was to create a standards-based layer (or layers) on top of the disparate infrastructure. This new layer—formed initially by individual Web services specifications and, increasingly, by comprehensive SOA-based initiatives—can serve as a common foundation for development, communications and business process flow.

In this paper's final section, we discuss some of the specific benefits—as well as challenges—companies can expect when adopting SOA-based principals and technologies. But our September 2005 survey of IT decision makers makes clear that many expect Web services and SOA to deliver strategic payoffs, not just tactical benefits. As Figure 4 indicates, our survey respondents believe both Web services and SOA will deliver competitive business advantage and value in addition to more tactical benefits such as reduced IT costs and improved IT performance and availability. Other important technologies, including server and storage virtualization, grid computing and utility computing, are more weighted toward the tactical benefits of IT cost reduction and performance improvement.

Figure 4

Infrastructure Software Technology Drivers



As suggested by our IT customer survey, Web services and SOA are critical elements fueling the trend toward dynamic computing, but aren't sufficient on their own to meet every customer demand. And, of course, no technology that isn't supported by powerful, accessible and dependable products will get far in the demanding—and budget constrained—world of corporate IT. In the following two sections, we examine how Oracle has ramped up its activities and broadened its infrastructure portfolio to support SOA as well as the full range of technologies and functions IT customers are increasingly seeking out.

Section 3 Oracle's Path to the Fusion Architecture

Oracle made its initial foray into the middleware market primarily to leverage and enhance its existing database and applications businesses. In fact, one can make the case that Oracle's first "middleware" initiatives took the form of extensions to its popular database. In the late 1990s, Oracle began to position

its database as an application development and deployment platform that provided much of the same functionality—file systems, directory, security, and so forth—that Microsoft and the commercial Unix vendors bundled into their operating systems.

Given the overwhelming importance of its database business to Oracle's overall success, the company's first forays into the nascent application server market were relatively tepid. If there was a question about where functionality should reside, Oracle tended to favor its database. In the 1999-2000 time-frame, however, Oracle started getting serious about beefing up and promoting its application server stack on its own merits. Within its Oracle Application Server portfolio, the vendor created a full spectrum of middleware capabilities, including the core J2EE application server as well as a directory server, a corporate portal, a business intelligence server, a B2B integration server, a wireless server, security services and other functions.

Oracle's middleware group moved quickly to support standards within its platform, first pushing hard into the realm of Java and J2EE specifications. With the 2001 release of its Oracle9i Application Server, Oracle began supporting the just-emerged Web services standards of SOAP, WSDL and UDDI. In the same year, Oracle also started talking about re-crafting its enterprise applications as Web services that could run on top of its standards-based middleware platform. (Oracle, in fact, had talked about using its middleware as the foundation for a "service-oriented architecture" as early as mid-1999, well before Web services took hold and certainly before the subsequent boom in interest in standards-based SOA deployments.) Oracle had initially designed its E-Business Suite of applications to run on its own proprietary middleware stack called Oracle Forms. Thanks to that tiered architectural approach, Oracle faced fewer hurdles in moving to a standards-based middleware model than did vendors who packaged lots of functionality into the applications themselves, rather than in a middleware layer.

Despite its early embrace of standards in its middleware, this aspect of Oracle's platforms was somewhat eclipsed early this decade when the vendor aggressively promoted all-Oracle solutions as a means to ensure optimal end-to-end interoperability and to cut escalating systems integration costs. Although Oracle still promotes its end-to-end platform capabilities, the company shifted its marketing message significantly in recent years.

The first major step in this shift came with the release of the Oracle 10g product line in late 2003, when Oracle began to emphasize heterogeneous, grid-based computing. In Oracle's approach, grids are optimally comprised of standards-based commodity servers, virtualized into networked pools of virtualized resources that can be tapped as needed by applications, services and automated business processes. A year later, the vendor began to promote its grid architecture as the optimal foundation for SOA-based computing, and also introduced the Oracle Information Architecture—said to help customers become "information-driven enterprises." The Oracle Information Archi-

ecture encompassed not only Oracle 10g infrastructure and management products, but also new integration capabilities and the Oracle E-Business Suite of enterprise applications.

At the September 2005 Oracle OpenWorld conference, the vendor aggregated all of these themes within its Oracle Fusion Architecture (OFA), which the vendor says encompasses the three “sub” architectures of: 1) Service-Oriented and Event-Driven Architecture, 2) Enterprise Information Architecture (a renaming of the Oracle Information Architecture) and, 3) Grid Computing. More than just a collection of products, OFA includes both products and best practices from Oracle and its partners, and is designed to serve as a blueprint for customers undertaking enterprise SOA implementations.

Oracle characterized OFA as being based on six key principles that collectively address the core IT-based challenges afflicting businesses today. Broadly, again, these pain points include the fragmentation and incompatibility of siloed systems, applications and data, the inflexibility of these systems to adapt to changing business needs, and the difficulty and expense of managing and securing these systems while also leveraging them in ways that more effectively support a company’s key business objectives. In response to this range of needs, the OFA encompasses:

1. The development of modular, service-oriented and event-driven applications that can be easily modified and can interoperate with other standards-based applications and services;
2. The design, monitoring and optimization of flexible business processes to ensure efficient business operations and high service levels, as well as tight IT/business synchronization;
3. The generation of consolidated, actionable intelligence and insight to help companies recognize important business events and trends and to respond to them in the most effective ways possible;
4. The use of clustered databases and a unified data model to consolidate and normalize distributed and inconsistent information so that all applications and users can work from accurate and common master data;
5. The use of collaborative portals to connect people, processes and systems to make them more efficient and productive; and
6. The deployment of a scalable grid infrastructure built with low-cost commodity systems and managed with unified identity management and security capabilities to reduce costs and create a flexible pool of resources that can be applied to processing and business tasks on an as-needed basis.

Oracle’s collection of middleware software, now called Fusion Middleware, is positioned to deliver most of this range of capabilities, but also to be open to products and capabilities delivered by Oracle’s partners and other third parties. As discussed in the following section, Fusion Middleware aggregates a variety

of development tools, deployment platforms, management capabilities and underlying technologies into a comprehensive and standards-based technology platform. Oracle stresses that Fusion Middleware's native support of open standards means that customers can substitute third-party components for any of the elements in the Oracle infrastructure portfolio in a "hot-pluggable" fashion. A customer whose infrastructure is based largely on Oracle's platforms, for example, might choose to use a Novell directory server rather than Oracle's directory, or could use development tools other than JDeveloper to create Web services to run on the Oracle infrastructure. For the same reasons, Oracle notes, customers can deploy its middleware components within environments based largely on competitive platforms such as IBM WebSphere or BEA WebLogic. A WebSphere user, for instance, might use Oracle's process orchestration engine, its identity management capabilities, or other elements of the Fusion Middleware stack.

Oracle Fusion Middleware also serves as the foundation for the company's Fusion initiative. This is the vendor's multi-year plan to modularize and unify the disparate product lines currently residing within its applications portfolio. These lines include Oracle's internally developed E-Business Suite applications, along with the acquired PeopleSoft, JD Edwards and Retek portfolios and iFlex. If all goes as planned, this collection will soon become even more diverse with Oracle's acquisition of CRM leader Siebel Systems. As part of the Fusion initiative, Oracle will gradually select best-of-breed functionality from its collection of applications and instantiate that functionality as common services that can be shared by its own as well as third-party applications. Oracle also intends to convert about 2,800 proprietary business workflows that currently exist in its E-Business Suite into standards-based workflows and services objects using the standard Business Process Execution Language (BPEL).

Oracle sells its Fusion Middleware platforms independently as well as bundled with its E-Business Suite of applications. It has certified PeopleSoft Enterprise and JD Edwards EnterpriseOne applications with Fusion Middleware as well. At the end of 2005, Oracle reported having a Fusion Middleware customer base of more than 28,500 companies, and also claimed to have a network of more than 7,500 independent software vendors, value-added resellers and systems integrators building solutions on Fusion Middleware.

Section 4 Fusion Middleware Forms Comprehensive SOA Platform

As suggested earlier, Oracle is reaching out to partners to extend and enhance its product line, and to contribute additional elements to the overall architecture. Given the span of Fusion Middleware, it's beyond the scope of this paper to review every component in the portfolio. However, it is worth highlighting a number of Oracle's products and technologies to provide a sense of Fusion Middleware's range. The breadth of Oracle's technology platform is one of the vendor's key strengths in the highly competitive middleware market.

Fusion Middleware, as defined by Oracle, includes services development, registry and orchestration tools, various runtime and integration platforms, services monitoring and management capabilities and business intelligence/analysis products. Among the most notable are:

- **Oracle JDeveloper.** Oracle's well-established development tool, JDeveloper, has evolved to support the modeling, coding, testing, deployment, assembly and maintenance of standards-based services as well as traditional Java, J2EE, and PL/SQL code. The tool is complemented by the Oracle Application Development Framework (Oracle ADF), a model- and best-practices-driven SOA framework that automates and manages business and data services. Oracle ADF provides a standard data- and service-binding layer that can be used with process flows, page flows, and service invocations, and also implements SOA design practices to make user interfaces as loosely coupled as services themselves.
- **Oracle Data Hubs.** A growing family of products designed to provide a central mechanism for synchronizing the disparate data spread across distributed IT environments. The Data Hubs create a "single source of truth" to ensure that users and applications are all working with consistent and up-to-date information. Oracle currently offers Data Hub products to create master data for three categories of information: Customer Data Hub, Financial Consolidation Hub and Product Information Management Data Hub.
- **Oracle BPEL Process Manager.** Providing support for the BPEL Web services orchestration standard, Oracle's BPEL Process Manager includes a graphical interface to help users design and build business processes and an engine for executing the processes. The foundation for Oracle's BPEL technology came from the its mid-2004 acquisition of a small specialist firm, Collaxa, which gave Oracle a significant head start over its major middleware competitors in this important area.
- **Oracle Business Rules.** This capability lets users establish rules and policies that govern the activities and priorities of the computing infrastructure and applications. Users can create new rules or can extract applicable rules out of existing applications or business processes. The resulting rules and policies can then automate many of the operations of other elements of the infrastructure, including Oracle Portal, Oracle BPEL Process Manager and Oracle BAM.
- **Oracle Portal.** An integrated framework for developing, deploying and managing enterprise portals, Oracle's portal enables secure information access, self-service publishing, online collaboration and process automation. Users can feed applications to the common portal interface using standards such as HTTP, XML, and SOAP, and can also incorporate Web Services and J2EE-based components such as Java Server Pages (JSPs), Java Servlets, and Enterprise JavaBeans (EJBs) into the portal as portlets, without writing additional code.

- **Oracle Business Activity Monitoring (BAM).** Oracle BAM provides real-time and graphical access to critical business performance indicators, generates proactive alerts, and supplies supporting information to improve the speed and effectiveness of business operations. By integrating BAM with existing systems, customers can track processes and service levels, capture business events, and optimize processes by identifying bottlenecks.
- **Oracle Identity Management.** Oracle supplemented its own LDAP directory and identity management capabilities with the early 2005 acquisition of federated ID management specialist Oblix and followed with the late 2005 acquisitions of Thor Technologies (provisioning systems) and Octet-String (virtual directory). Based on Liberty Alliance, SAML, WS-Security, WS-Authentication, and other standards, Oracle's identity management capabilities allow customers to manage authentication and access across multiple company boundaries and to simplify user requirements through mechanisms such as single sign on.
- **Oracle Web Services Manager.** The Web Services Manager is also based on technology gained from the Oblix acquisition, in this case the Oblix COREsv product. The re-branded product provides tools for building security and operations policies for Web services and other applications, facilities for intercepting calls to and from applications and services so that the established policies can be applied, and dashboards for monitoring the management policy execution and the resulting service levels.
- **Oracle Business Intelligence.** Oracle's suite of BI capabilities includes query, reporting, analysis, data integration and management, desktop integration, as well as business BI application development tools.
- **Oracle B2B Server.** This platform lets companies define, configure, manage and monitor the electronic exchange of business-to-business (B2B) information with its trading partners. Oracle's B2B integration capabilities include support for a large number of industry interoperability standards (e.g. EDI, UCCnet, RosettaNet, ebXML, etc.), document types (e.g. UAB, HL7, UN/EDIFACT, X12 variants, etc.) and message formats (e.g. MIME, SOAP, FTP, HTTP, SMTP, etc.).

Again, the above list of Fusion Middleware components isn't meant to be comprehensive. Oracle also offers messaging and collaboration products, content management, and various other relevant products. Furthermore, Oracle's portfolio includes three core products that can form the cornerstone of a SOA implementation. The first, the Oracle Service Registry, is a UDDI v3 compliant registry for provisioning, discovering and governing Web services. It serves as a central repository and point of control for Web services created by Oracle and others, permitting users to easily find pre-built services that may address specific requirements. The second product, Oracle ESB, evolved from the Oracle Interconnect product, and performs message routing and transformations for a wide variety of standard and de facto protocols, among other functions. The

third, Oracle Metadata Services encompasses a variety of metadata services to, for example, describe at a high level of abstraction the components that make up an application or the rules that govern responses to business events.

Thanks to Oracle's adoption of applicable standards throughout its products, Fusion Middleware collectively can serve as a comprehensive platform for SOA and EDA implementations. Meanwhile, each individual product or capability can provide users with a mechanism to incrementally begin building Web services and SOA capabilities that can later be expanded with other products within the Fusion Middleware portfolio. We discuss some of the reasons for starting SOA projects sooner rather than later in the following section.

Section 5 First Steps for Companies Wanting to Realize SOA Benefits

As should be clear, SOA and other high-value technologies such as virtualization and policy-based management long ago passed the theoretical stage. Many IT customers are well along in adding these capabilities to address both tactical IT and strategic business needs. They are also beginning to explore and adopt synergistic technologies such as event-driven architecture and business activity monitoring, which complement SOA and which will increasingly be considered to be necessary capabilities that reside under the overall SOA umbrella. Companies are being aided in their efforts to adopt the full range of SOA functionality by the growing availability of standards-based products, including those comprising Oracle's Fusion Middleware.

Still, companies need a starting point—or, more accurately, optional starting points, depending on their capabilities and requirements—to adopt SOA. Although it's tempting for IT managers to start by tackling some of the technical aspects of SOA, that typically isn't the best first step. Even before beginning to develop, expose and manage services as part of a SOA project, IT managers must first enlist the backing and participation of their companies' business executives and line-of-business managers in the process. In fact, SOA—whose entire purpose, after all, is to establish more flexible and agile IT resources to better support business activities—will often serve as the mechanism that catalyzes a more collaborative and effective relationship between a company's IT and business groups.

SOA, in effect, requires breaking down the wall that often exists between the IT department and the business units. For their part, developers must start to reorient their technology-centric perspectives, and also may have to cede some control to business strategists and users. These business users, in turn, will increasingly be able to rely on rapid IT support for addressing new business needs. Over time, business users will also be able to create and modify applications and business processes by composing services themselves, rather than asking IT developers to code them. The sharing and reuse of common services across a company will also require different business units to become less territorial, so that broad corporate standards and services can be established and used consistently.

Once IT and business managers jointly commit to pursuing a SOA strategy to improve their business agility, the first step for many firms is to wrapper and expose existing application functionality as Web-services-enabled services that users and/or applications can access via standard interfaces. In addition to SOA-enabling their internal applications, customers can increasingly also tap their familiar packaged applications via the same standard interfaces. That's because Oracle and other application vendors are breaking their code into functional modules that can function and be accessed as independent services.

This adoption of Web services standards within the major application suites will make it easier for customers to integrate elements of the packaged applications with internal software applications that have been exposed as Web services. Web services support also allows vendors with different application products in their portfolio to easily build bridges between them, as Oracle has done, for example, in building standards-based interoperability between its Retek and Oracle E-Business Suite financial modules.

All three of Oracle's major applications lines are being componentized into "enterprise services" that are exposed via Web services interfaces. For Oracle, enterprise services go beyond simple Web services by providing business-defined functionality with enterprise-level scalability, robustness, security, manageability and supportability. All of the Oracle applications enterprise services also support a shared semantic framework through the adoption of the Open Application Group (OAG) definition of business documents. The mechanisms used by the Oracle application lines to expose their functionality as Web services are:

- **XML Gateway in Oracle E-Business Suite**—provides XML messages for both inbound communication to Oracle E-Business Suite and outbound communication from it. More than 167 XML Gateway messages exist in Oracle E-Business Suite, from Sales Orders to Price Inquiries to Adding a Customer.
- **Integration Broker in PeopleSoft Enterprise**—provides the foundation for exposing Web services within PeopleSoft by supporting both synchronous and asynchronous calls along with offering routing and transformation capabilities. Users can access standard PeopleSoft business logic and transaction units via the PeopleSoft Component Interface infrastructure. More than 1,000 Web services are already pre-defined within PeopleSoft Enterprise as Enterprise Integration Points.
- **Web Services Gateway in JD Edwards EnterpriseOne**—provides the foundation to produce and consume Web services via Integration Points. Composite services offer commonly accessed business functionality such as adding a sales order or checking a price.

Beyond tapping the emerging collections of vendor-supplied application services, corporate developers can also use tools such as JDeveloper and Oracle

ADF to build their own modular services from scratch. However, even with development tools such as this that automatically create Web services-compliant code or wrapper existing code to expose via standard Web services interfaces, developers must first become comfortable with the requirements and objectives of doing loosely coupled, message-based programming.

One of the core objectives of service-oriented programming, of course, is to create services that encompass the right amount of functionality to be useful and to encourage code reuse. In this regard, it can sometimes prove difficult to pick the correct granularity of a service component. If the service is too fine grained, it may need to rely constantly on other services—which can lead, in effect, to tight coupling of the inter-dependent services. By contrast, if a service's functionality is too broad, a company can lose some of the benefits of service reuse and interchangeability.

When companies first begin to create and deploy Web-services-based solutions, they often aren't too concerned with issues such as services security and manageability. As the number of services grows, however, companies soon need mechanisms to store and register the services, to ensure their availability, to limit their exposure only to authorized users or applications, to monitor their use and their performance, and to modify them over time as necessary. They also need to begin to establish and apply rules to govern the identification of business-relevant events and the appropriate responses to them. As a result, even companies that start with bounded, point-to-point solutions can benefit greatly by quickly putting in place the registry, business activity monitoring and management mechanisms that will be required as SOA and EDA proliferate throughout their organizations.

IT managers who have begun SOA deployments commonly cite reductions in development costs and increases in development productivity that they attribute to the loosely coupled SOA model. Meanwhile, companies that implement SOA environments internally can more easily leverage the growing collection of external services offered by software-as-a-service providers and other third parties.

Most current generation SOA deployments are too new or too limited in scope to have realized the sweeping advantages that can come from creating a modular, highly adaptable IT infrastructure companywide. As depicted in Figure 1 at the beginning of this paper, however, most of the early SOA adopters that Summit Strategies has studied expect this flexible architecture to pay significant dividends—be it via reduced IT development, testing and maintenance costs or, ultimately, via a tighter linkage between an adaptable IT infrastructure and an ever-changing business environment.

The ongoing industry shift toward SOA and dynamic computing may not be as quick to arrive or as glitzy as the rise of the commercial Internet, but its impact could prove as far reaching. As SOA deployments proliferate, companies, their partners and their customers will realize wide ranging benefits due

to the flexibility of the services-oriented approach, and will increasingly view IT as having a critical and integral role in supporting their overall business strategy. Those companies that prove adept at riding the SOA wave will realize significant advantages over competitors that resist this computing trend. And vendors such as Oracle, with its Fusion Middleware, are making it increasingly straightforward to begin the SOA journey.

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