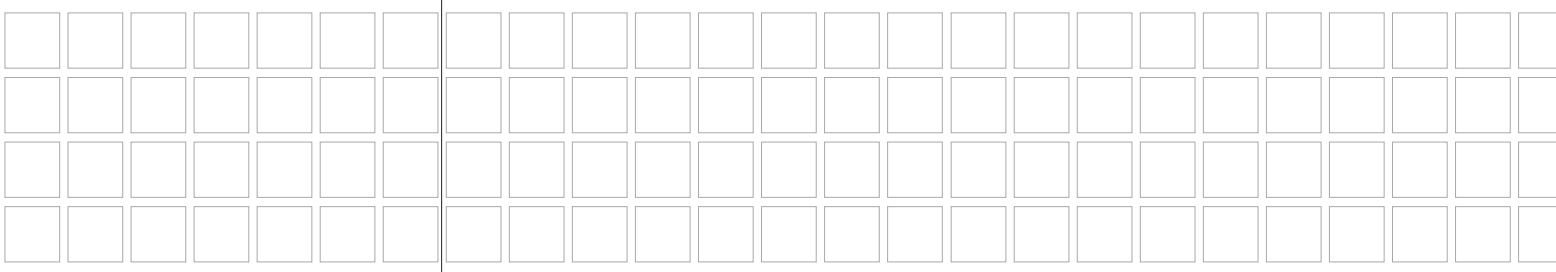
A NEW SERVICE-ORIENTED ARCHITECTURE (SOA) MATURITY MODEL



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> FOREWORD

This whitepaper and the model it presents was created to better enable organizations in their quest for business agility through service oriented architecture (SOA). The SOA Maturity Model outlined in this paper was specifically developed to offer guidance to managers who may be struggling to communicate the business value of their SOA vision and to be able to benchmark SOA adoption within their organization.

We look forward to receiving feedback and commentary on this model, as we will continue to expand its content and share SOA successes. Enjoy!

> 1.0 INTRODUCTION AND MOTIVATION

In an environment where the strategic value of IT is questioned[1] and the pressure is on for every IT and software development organization to cut costs, even the discussion of the strategic business value of technology can get lost. Much attention has been devoted to methods of reducing costs such as outsourcing and offshoring, but less attention has been focused on the business enablement value of new technology.

The goal of this paper is to show how a new approach to designing and deploying information technology, specifically service oriented architecture (SOA), can form the basis for the technology and business organizations to work in concert for the improvement of business performance along several dimensions including cost reduction and streamlining the implementation of new business models. More specifically, this paper provides:

- A framework for discussion that enables an organization to understand what the path toward adopting a SOA should be.
- An articulation of the business benefits of successful migration towards SOA, divided into multiple levels of maturity of SOA implementation.
- A meaningful vocabulary and context around which an organization may seek alignment between IT and the Business.
- The basis upon which an organization may build a roadmap towards true business agility through successful adoption of SOA

SOA is an approach to designing, implementing, and deploying information systems such that the system is created from components implementing discrete business functions. These components, called "Services", can be distributed across geography, across enterprises, and can be reconfigured into new business processes as needed.

All claims for new technology are subject to skepticism, so what makes SOA different from other approaches of the past? The key factors are:

- SOA is built on the standards of the World Wide Web leading to cost-effective implementations on a global basis with broad support by vendors.
- Services are "loosely-coupled" allowing for much more flexibility than older technologies with respect to re-using and re-combining the services to create new business functions both within and across enterprises.
- SOA best practices create designs which embody business processes—and enhance the ability to outsource and extend processes to business partners.
- SOA encompasses legacy (i.e. existing) systems and processes so that the usefulness of existing investments can be preserved and even increased.

[1] Carr, Nicholas G., *Does IT Matter?,* Harvard Business School Press, 2004.

This combination of factors makes SOA an approach which provides a winning strategy for all stakeholders as:

- The finance organization sees cost effectiveness.
- The business organization sees enhanced and expanding business models (as shown later in examples).
- The IT organization sees success in supporting their customers, meeting service goals, and having the flexibility to respond to future demands through increased agility.
- Corporate governance sees improved alignment of IT and business.

As companies look to the challenge of figuring out how to obtain the benefits of SOA, how to justify the required investments, where to begin, and what vision to aim for, guidance is required. The solution presented in this paper is the introduction of a SOA Maturity Model (SOA MM) to show the increasingly positive impact which SOA adoption can have from a business perspective. The SOA MM derives from three key inspirations:

- The successes of the Capability Maturity Model® (CMM) and newer CMM Integration (CMMI℠)[2] from the Software Engineering Institute (SEI) in providing a common framework for defining and assessing process improvement in software and other engineering endeavors.
- Papers such as those by Randy Heffner of Forrester Research[3] showing the various successful paths taken by companies introducing SOA.
- The success of our customers in the deployment of SOA projects.

By putting SOA into a framework similar to the Capability Maturity Model®, we can show the goals, characteristics, and prerequisites to SOA's business impact progressing through levels as follows:

New Functionality	*Cost Reduction*	*Business Responsiveness*	*Business Transformation*	*Business Optimization*

The SOA MM includes goals, characterization of the scope and business benefits of each level, the important industry standards, key practices, and critical success factors, both technological and organizational. The SOA MM thus provides guidance to set SOA vision and a benchmark to measure progress.

Forrester Research has found that companies approach SOA through different paths, each with different business benefits, skills, and technology infrastructure requirements. For some companies a focus on internal integration and workflow is most important, while for others a focus on partner integration is most important. As companies pursue the specific paths appropriate to their needs, they can correlate their paths with the maturity model to see the organizational needs, technology needs, and goals as they move up the levels of SOA maturity.

[2] Software Engineering Institute, *Capability Maturity Model® Integration,* http://www.sei.cmu.edu/cmmi.
[3] Heffner, Randy, "Your Paths to Service-Oriented Architecture", Forrester Research, Dec. 2004.

> 2.0 WHAT IS SOA (SERVICE-ORIENTED ARCHITECTURE)?

SOA is an evolution of distributed computing designed to allow the interaction of software components, called "services", across a network. Applications are created from a composition of these services — and importantly, the services can be shared among multiple applications.

For example, a Human Resources management application could be created from the following services:

- An Employee Administration Service to manage hiring, changes in status, and termination.
- A Salary and Review Administration Service to manage salaries and employee performance reviews according to corporate standards.
- A Benefits Administration Service to initiate and terminate benefits, and to process the annual enrollments.
- An IT Security and Provisioning Service to manage the addition and removal of access rights for employees according to their role and employee status.
- A Payroll Service provided securely over the Internet by an outside provider.
- An HR Department Portal Service providing a web browser based user interface for members of the HR department presenting the functions of the above services.
- A Business Process Management Service to manage the approval and notification processes.

With SOA, organizations can achieve greater reuse of existing assets and can respond faster to change requests. These benefits are attributed to several critical elements of SOA:

- *The services reflect logical business activities.* Each service typically performs multiple operations for a specific business function such as a Payroll Service providing operations including "issue checks", "issue W2s", and "provide payroll period report". Importantly, these services, often referred to as "course-grained", reflect business process concepts, not the capabilities or "fine-grained" API's defined by traditional packaged software applications.
- *New services can be added or created by composing existing services without impacting the existing service implementations*[4]*.* So, in the example above, an Employee Self-Service component could be added making use of the existing services, filtering data and operations to those appropriate for the self-service users. This allows for an "incremental deployment" approach in implementing services.
- *The services can be on heterogeneous systems across networks and geography providing platform independence and location transparency.* There is no need for each service to be implemented using the same software or hardware technology nor to be on the same network or in the same location. The Salary and Review Administration Service could be implemented in a COBOL environment on a Linux/mainframe server in one locale while the IT Security and Provisioning Service could be implemented in a Microsoft .NET environment on a Windows server in a different locale.
- *The services communicate by standard protocols providing broad interoperability.* Most commonly, especially for connecting heterogeneous systems, these are protocols based on World Wide Web standards. "Web services" are the implementations of services using these standards. Amazon and eBay are high-profile examples of corporations which have made their core applications accessible over the Internet as Web services.

[4] Care must be taken with respect to security and service level agreements (SLA) when adding new "consumers" to existing services.

- *Legacy application systems can be integrated as a service leveraging existing investments.* SOA technology provides mechanisms to front-end (or "wrap") existing systems behind a services interface with no changes to the existing system. In addition traditional ERP vendors are quickly exposing their applications' functionality as Web services.
- *Services have an interface and are message-oriented.* The functionality provided by services is defined by meta-data describing the interface to the service and its operations. Information is transmitted to and from services as messages. The focus in the definition of the interface and messages is in "what" a service does rather than "how". The "how" is internal to the implementation of the service. SOA applications are usually designed to be "event-driven" responding to the messages as they arrive.

An implementation of SOA relies on skills, methods, and a SOA infrastructure to support the SOA application in a reliable, scalable, and secure manner. Some of the basic elements of this new approach include:

- *Analysis, design, and implementation methodologies* to guide project managers, developers, and IT operations personnel in the rapid design, assembly, and reuse of SOA components.
- *Modeling, configuration, testing and deployment tools* to specify and create the services and then define business processes which orchestrate those lower level services into coarse grained business services.
- *Enterprise Service Bus (ESB)*[5] to provide reliable, scalable, distributed communications and data transformations between services as well as providing adapters to legacy technology and various vendor implementations.
- *Services and Policy Registry and Repository* to provide a common place to organize, understand and manage SOA information including a catalog of available services, their interface definitions, and policies governing the use of services.
- *Provisioning and Infrastructure Management Tools* to provide Business Process Visibility (BPV) across a widely distributed SOA infrastructure.
- *Runtime Governance* to define and control security and business policies and enforce regulatory compliance across tiers of software in a way which reflects the underlying business processes.

[5] Chappell, David, *Enterprise Service Bus*, O'Reilly, 2004.

> 3.0 THE SOA MATURITY MODEL

The introduction of SOA can provide a focus for the technology and business organization in a company to meet common goals of the enterprise. A SOA Maturity Model can provide goals and guidance on how SOA can have an increasingly positive impact on the enterprise.

Figure 1 shows the five levels of SOA Maturity along with the key business impact progressing from least to most mature as follows: Initial Services, Architected Services, Business Services and Collaborative Services (two different focuses at level 3), Measured Business Services, and Optimized Business Services. Also shown for reference are the corresponding CMMI[SM] levels[6].

Figure 1: Service-Oriented Architecture Maturity Model Levels with Key Business Impact

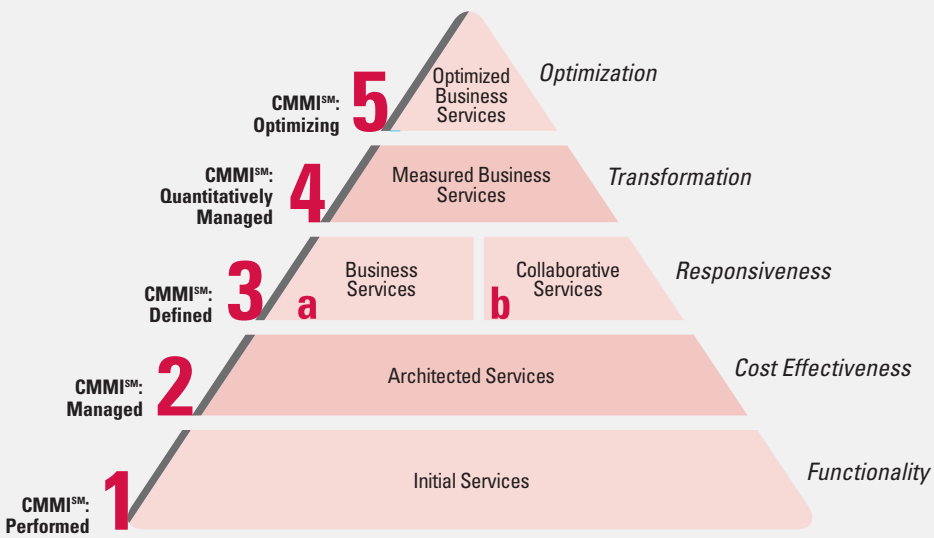


Table 1 shows the key attributes of each maturity level including business impact, scope, critical success factors, and relevant standards. Consistent with the approach taken by the SEI for the Capability Maturity Model®, Key Goals and Practices for each SOA maturity level are specified in Table 2. Attainment of these goals and the implementation of these practices is the measure as to whether a maturity level has been attained. Each maturity level has as a prerequisite the goals and practices of the lower levels.

It will often be the case that particular goals will be achieved, practices implemented, and technologies used at levels lower than those shown in Tables 1 and 2. This is to be expected and encouraged according to the priorities of the enterprise.

Subsequent sections will examine each of the SOA maturity levels.

[6] In very short summary: CMMI[SM] Performed means that needed functions are performed, CMMI[SM] Defined means that standard processes are defined, CMMI[SM] Managed means that the standard processes are implemented and managed, CMMI[SM] Quantitatively Managed means that the results of the processes are measured against goals, CMMI[SM] Optimizing means that there is a continuous improvement process implemented based on the measurements.

Table 1: SOA Maturity Model

Maturity Level	Prime Business Benefits	Scope	Critical Technology Success Factors	Critical People & Organizational Success Factors	Selected Relevant Standards
1. Initial Services	New functionality	R&D experimentation, Pilot projects Web site, Portal, Custom integrations, Small number of services	Standards, Legacy Integration	Developers learn service development skills Developer Manager Sponsorship	XML, XSLT, WSDL, SOAP, J2EE, .NET
2. Architected Services	IT cost reduction and control	Multiple integrated applications	Support for heterogeneity and distributed systems, Reliable Messaging, Mediation, Ease of deployment, Database integration, Versioning, Internal Security, Performance management	Architecture group provides leadership, SOA Competency Center CIO Sponsorship	UDDI, WS-ReliableMessaging, WS-Policy, WS-Addressing, XQuery, WS-Security, SAML
3.a. Business Services	Business responsiveness — change business processes quickly and effectively	Business processes across business unit or enterprise	Reuse, Ease of modification, Availability, Business process rules, Event-driven processes, Composite applications	IT Partnership with Business, Partnership across Organizations, SOA Life-cycle Governance, Executive commitment, Event-driven design skills Business Unit Manager Sponsorship	WS-BPEL
3.b. Collaborative Services	Business responsiveness — collaboration with business and trading partners	Services available to external partners, Cross-enterprise	External services enablement, Cross-enterprise security, Translation of cross-enterprise protocols, Long-running transactions		RosettaNet, ebXML, WS-Trust
4. Measured Business Services	Business transformation from reactive to real-time, Meet business performance metrics	Business unit or enterprise, Cross-enterprise	Business Activity Monitoring, Event Stream Processing, Complex Event Processing, Event-driven dashboards and alerts	On-going business process evaluation and response CFO Sponsorship	
5. Optimized Business Services	Business optimization — react and respond automatically	Business unit or enterprise, Cross-enterprise	Event-driven automation for optimization	Continuous improvement culture CEO Sponsorship	

Table 2: SOA Maturity Model Goals and Key Practices

Maturity Level	Key Goals	Key Practices
1. Initial Services	1. Learn SOA technology in R&D and pilot projects. 2. Apply SOA technology to immediate organizational needs. 3. Define initial ROI measurements for SOA projects and apply to initial projects.	1. Create services definitions. 2. Integrate SOA into project development methodology. 3. Quantify costs, time, and business benefits of pilot projects.
2. Architected Services	1. Institutionalize use of SOA. 2. Put in place architecture leadership for SOA. 3. Prove returns from use of standards technology. 4. Anticipate use of SOA information for business optimization.	1. Specify technology standards for SOA. 2. Integrate SOA into organization-wide development process. 3. Provide organization-wide SOA training and competency center. 4. Use incremental integration.
3.a. Business Services	1. Create ongoing partnership between business and technology organizations for SOA governance. 2. Support full business processes via SOA. 3. Prove returns from reuse of services and responsiveness to change.	1. Specify policies for use of SOA in creation or modification of business processes. 2. Take advantage of event-oriented and mediation functionality of SOA technologies, especially with regards to enhancing/extending business processes.
3.b. Collaborative Services	1. Create ongoing partnership between business and technology organizations for SOA governance. 2. Extend SOA business processes to external organizations 3. Prove returns from use of services for collaboration.	1. Specify policies for use of SOA in collaboration with business and trading partners 2. Implement cross-enterprise security.
4. Measured Business Services	1. Institute transformation from reactive to real-time business processes. 2. Define and meet business-oriented performance metrics.	1. Collect and analyze business process-oriented real-time performance metrics. 2. Implement ongoing business process evaluation and re-engineering.
5. Optimized Business Services	1. Provide enterprise-wide leadership for business and SOA governance. 2. Prove returns from SOA-supported continuous improvement.	1. Implement self-correcting business processes.

> 3.1 SOA MATURITY LEVEL 1 — INITIAL SERVICES

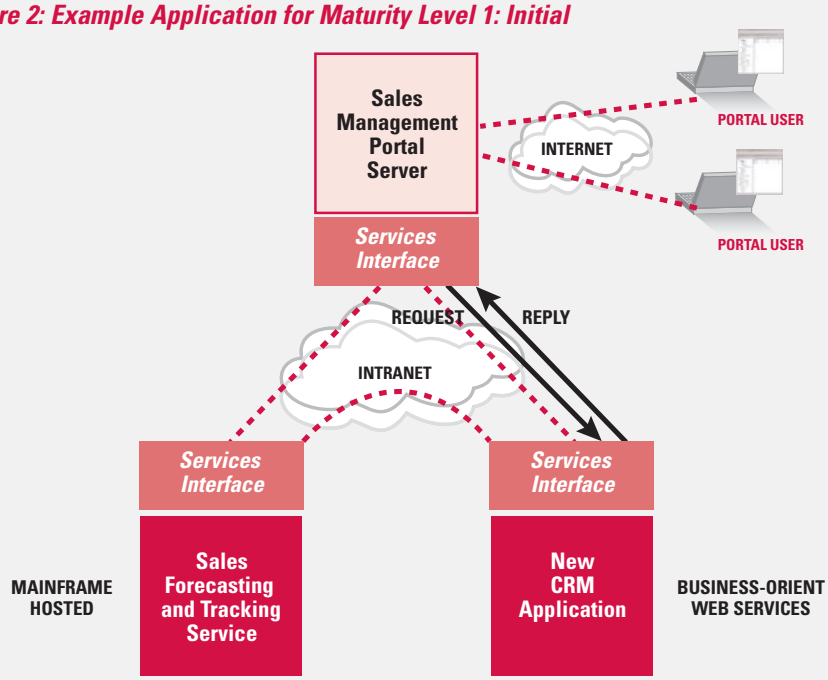
SOA Maturity Level 1 is Initial Services (see Table 1 and Table 2). Initial Services represent the initial learning and initial project phase of SOA adoption. Projects here are typically done to simultaneously meet a specific need to implement functionality while trying out specific technologies and an approach to SOA. This maturity level also includes initial R&D activities testing the SOA technologies in a laboratory environment. Usually, the initial introduction of SOA is driven by the application development organization—often as part of an application integration project. New development skills are learned and initial attempts at quantification of ROI are created.

This is the level at which the most basic of SOA standards from W3C[7] are introduced such as XML for definition of message formats, WSDL for service interface definition and SOAP for invocation of services.

A typical example of an initial services project as shown in Figure 2 is to link a corporate sales force Web portal directly to both a legacy sales forecasting system running on the mainframe and a new CRM application exposed as a Web service. In this example the following SOA infrastructure component could be used:

- A *Mainframe Integration Service* such as DataDirect's Shadow RTE providing bidirectional standards-based Web service access to a legacy sales forecasting system hosted within CICS on an IBM mainframe running z/OS.
- A *Highly-Productive Development Platform* optimized for the creation of service-oriented business applications such as Progress OpenEdge to develop and host new CRM application logic that is accessible as Web services.

Figure 2: Example Application for Maturity Level 1: Initial



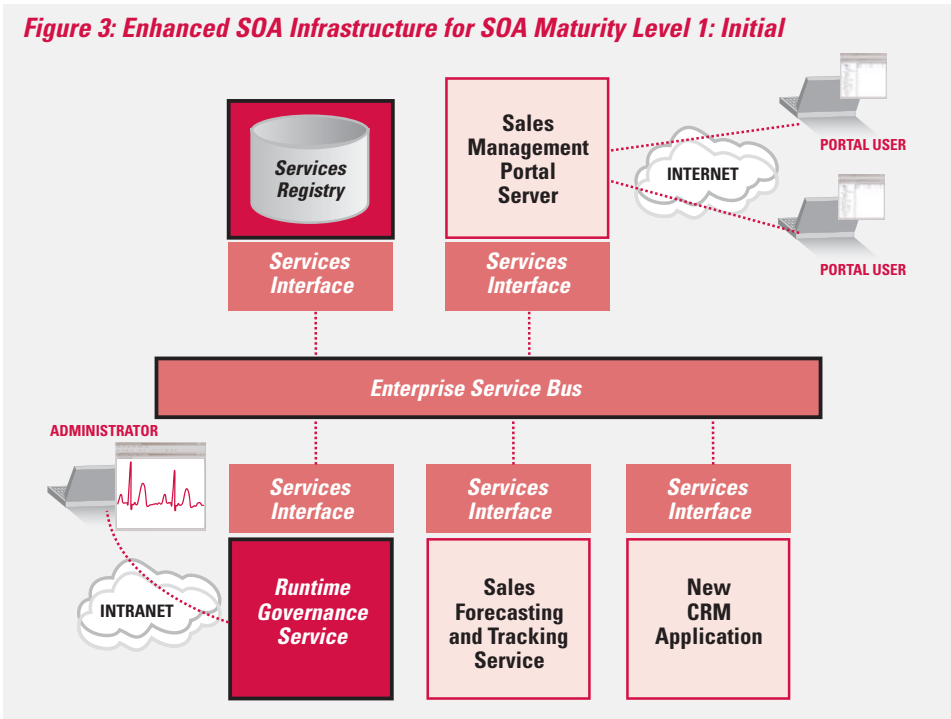
[7] World Wide Web Consortium, "Web Services Activity", http://www.w3.org/2002/ws/.

The key benefits of this initial project are to provide the business functionality required while also learning how to develop and deploy a basic SOA application. Such an implementation would use the SOAP protocol between the portal server and the supporting services, as well as for the Sales Forecasting and Tracking Service to obtain information from the CRM Application.

However, even a basic initial application could benefit from using some of the key additional SOA infrastructure components. Beyond the learning gained from using the technologies early, the most important reason for the introduction of these advanced technologies on initial projects is to put in place scalable technology so that as SOA encompasses more business functions, the right foundations are in place. For example, Figure 3 shows this same example with the addition of:

- A *Runtime Governance Service* such as Actional's which provides the monitoring and control mechanism to apply service and security policies to all steps within a business process across heterogeneous SOA infrastructure elements.
- An *Enterprise Service Bus* (ESB) such as Sonic's ESB which provides a standard interaction model for SOA components including Web services and relational databases as a scalable, easy-to-deploy distributed infrastructure. The ESB provides a large number of adapters to allow services implemented in disparate technologies to interchange messages allowing, for example, a .NET application to communicate with a J2EE application at a services level.
- A *Services Registry* supporting the UDDI standard. This provides a central store of service definitions across initial projects and provides a single point of reference for service developers to obtain services definitions.

Figure 3: Enhanced SOA Infrastructure for SOA Maturity Level 1: Initial



> 3.2 SOA MATURITY LEVEL 2 — ARCHITECTED SERVICES

SOA Maturity Level 2 is Architected Services (see Table 1 and Table 2). It is at this level that standards are set as to the technical governance of SOA implementation, typically under leadership of the architecture organization. The key business benefit of this level is development and deployment cost reductions through the use of SOA standard infrastructure and components as compared to using older technologies or costs accumulated through multiple unique one-time projects. These benefits are greater in the heterogeneous environments typical of most enterprises.

Based on the learning and feedback from the initial services at Maturity Level 1, architectural standards and standard implementation technologies are defined. For example, standards are set for:

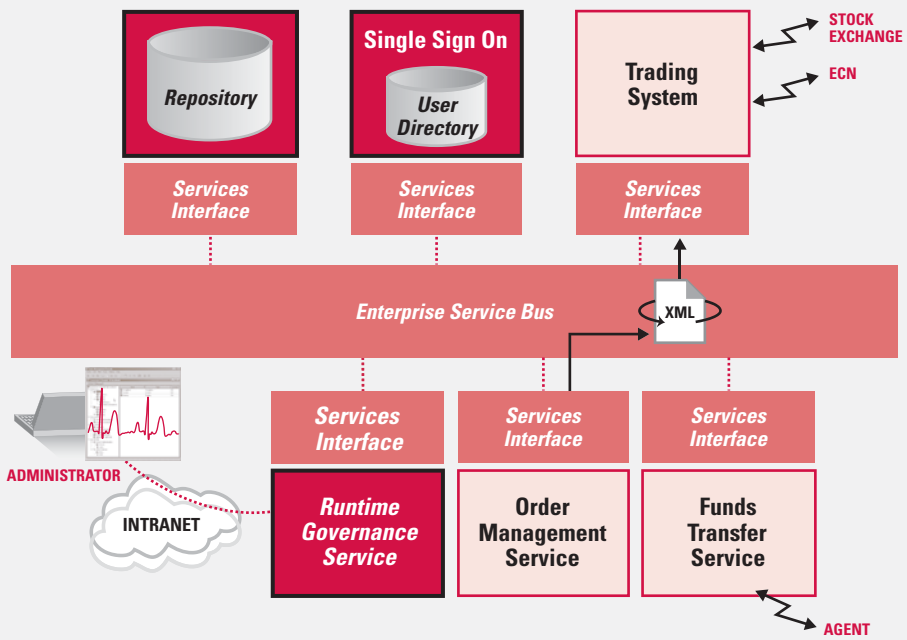
- Enterprise SOA protocols to be used chosen from industry standards, particularly those of W3C, OASIS[8] and WS-I[9].
- Implementation platforms to be used.
- Policies including reuse, runtime governance, compliance and security policies.
- Technical review process for definition of new services and reuse of existing services.

Figure 4 shows an example of an SOA deployment at Maturity Level 2 for a financial trading example. Maturity Level 2 includes the use of key components shown previously in Figure 3 including the runtime governance service and the Enterprise Service Bus as well as the additional key aspects of this example:

- A ***Repository*** which extends the Services Registry to provide storage for SOA artifacts and policies information. Lifecycle support such as access controls, versioning and deployment tools are also important characteristics to consider here. Usage of such a repository with both development and runtime support is part of Maturity Level 2—Architected Services.
- A modified ***Runtime Governance Service***, which identifies services and dependencies providing the proper foundation to detect, diagnose and automatically remedy both system and application-level errors.
- A ***Message Transformation Service*** which allows the integration of services with differences in expected message contents or formats. This is often done by the invocation of XLST transforms applied to an XML message—in this example as a "mediation" function under the control of the ESB.
- A ***Single Sign-On Service*** supporting user authentication and authorization across the organization. Such a service, typically supplied by a vendor, could be based on the OASIS SAML standard for the exchange of authentication and authorization information.

[8] OASIS, "OASIS Committees by Category: Web Services and SOA", http://www.oasis-open.org/committees/tc_cat.php?cat=ws.
[9] WS-I, Web Services Interoperability Organization, http://ws-i.org.

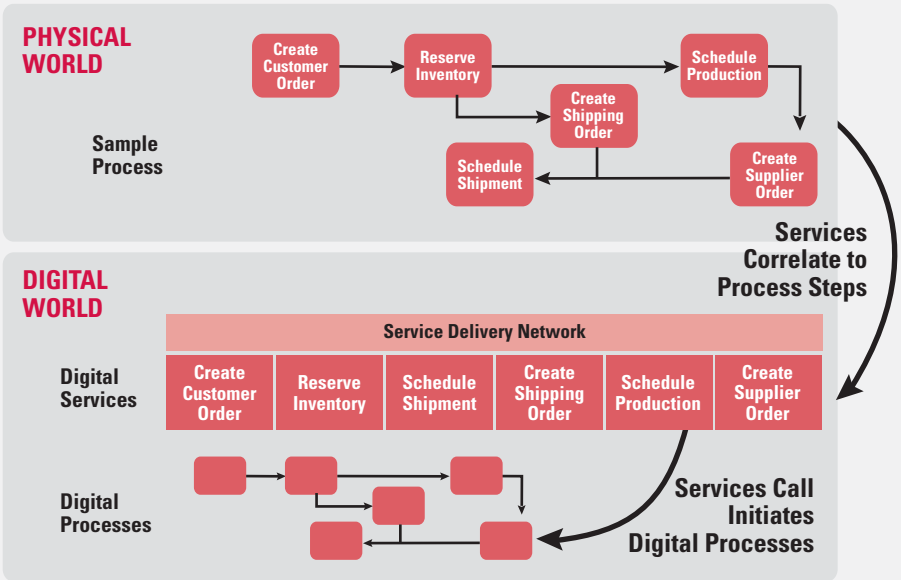
Figure 4: Example Application for SOA Maturity Level 2: Architected Services



> 3.3 SOA MATURITY LEVEL 3 — BUSINESS SERVICES AND COLLABORATIVE SERVICES

The focus of SOA Maturity Level 3 is on the partnership between technology and business organizations in order to assure that the use of SOA provides clear business responsiveness. Core to the value of SOA is the linkage between business processes and digital processes as shown in Figure 5.

Figure 5: SOA's Source of Power: It Models Business Processes (adapted from Forrester Research[10])



SOA Maturity Level 3 is defined with two complementary paths to attaining these goals—one, Business Services, focused on the improvement of internal business processes, and one, Collaborative Services, focused on the improvement of collaborative processes with external partners, (see Table 1 and Table 2). Certainly both can be done to get the greatest advantage from SOA, but Maturity Level 3 can be attained through either path—both provide improved business responsiveness.

[10] "The Big Strategic Impact Of Organic Business And Service-Oriented Architecture", Forrester Research, Inc., June 2004.

Figure 6 shows an example of an SOA deployment at Maturity Level 3 for financial trading. Key to this Business Services implementation is:

> *Business Process Management (BPM)*—the management of long-running processes involving sequential messages between services. This could be done for example by Sonic Orchestration Server which can manage the state of each process along with intermediate results.

Figure 6: Example Application for SOA Maturity Level 3: Business Services

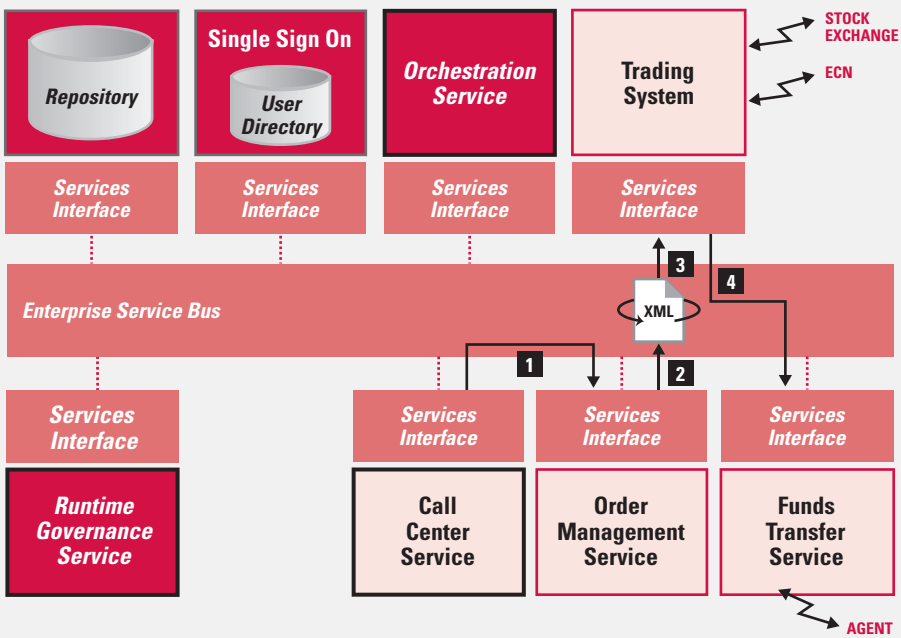
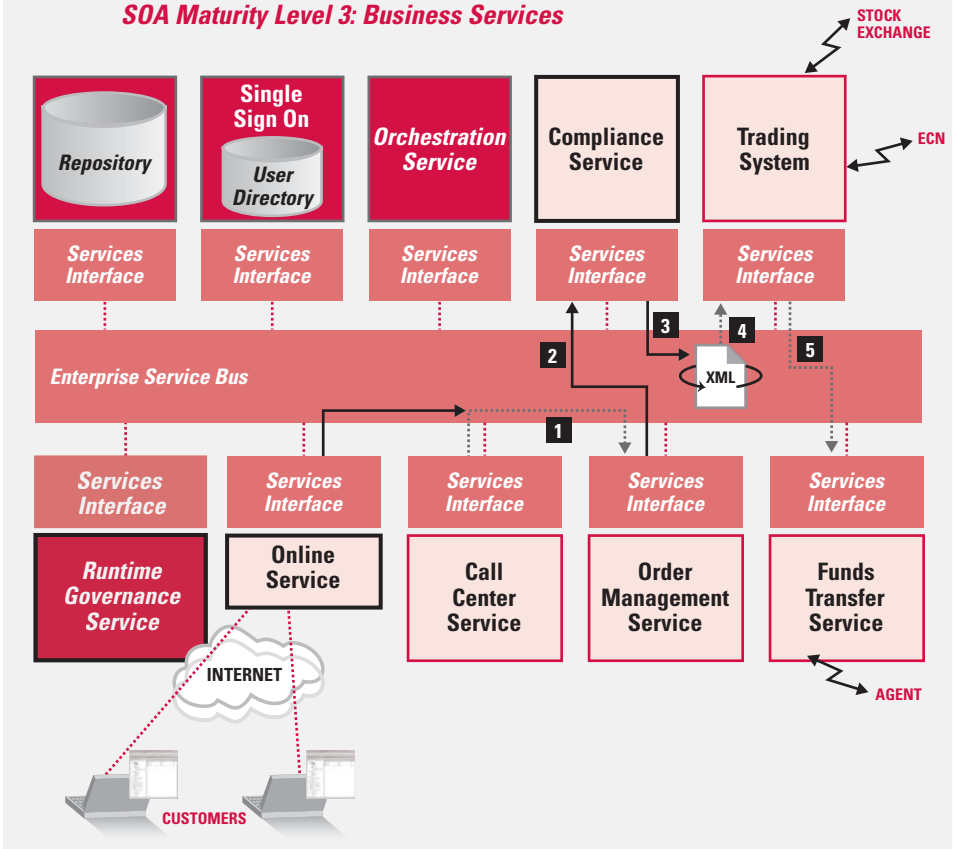


Figure 7 continues the evolution of Business Services with the addition of:

- ***Straightforward enhancement of business processes.*** A principal advantage of SOA is it's enablement of business process modification through the reconfiguration of services. In this example, a new Compliance Service required for regulatory compliance is inserted in the message flow between the Order Management Service and the Trading Service without any changes to the implementations of the existing services.
- ***Reuse of services.*** In this example, reuse is shown as through a multi-channel application (e.g. provide access to the same application through different customer communication methods) in which the Order Management Service is shared by both the Call Center Service and the Online Service.

Figure 7: Continued Evolution of Application for SOA Maturity Level 3: Business Services

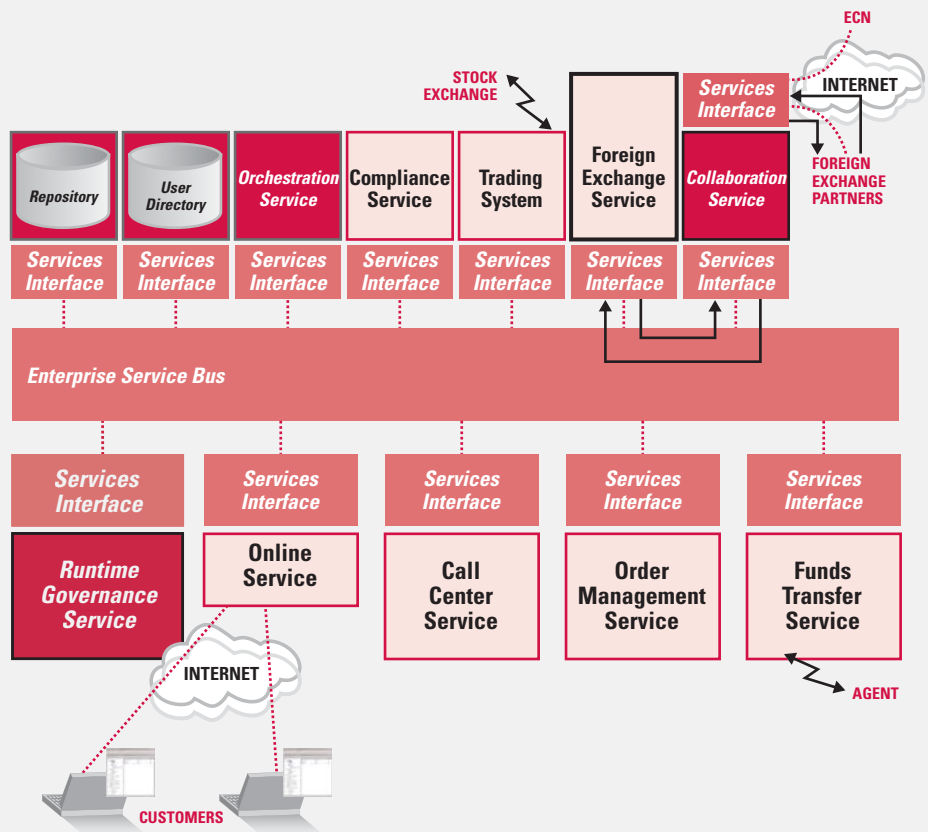


The alternative focus at Maturity Level 3 is Collaborative Services with a focus on linking with external partners. Figure 8 shows an example where the trading company expanded into a new business of foreign exchange transactions offered over the Internet.

Key features in this implementation of Collaboration Services include:

- Use of standard *SOA protocols supporting specific business-to-business (B2B) functionality* such as those defined by RosettaNet[11] which includes standard XML messaging functions for such cross-enterprise operations as obtaining product information, obtaining inventory information, and ordering.
- A *Collaboration Service* would implement the B2B protocols and supports necessary transformations between the messages used internal to the enterprise and those needed for external processes.
- The Electronic Crossing Network (ECN) connection has *moved from a proprietary protocol to a standard industry services protocol* and hence is managed through the Collaboration Service.

Figure 8: SOA Maturity Level 3: Collaboration Services



[11] RosettaNet, "Standards", http://rosettanet.org/standards.

> 3.4 SOA MATURITY LEVEL 4 — MEASURED BUSINESS SERVICES

While SOA Maturity Level 3 focuses on the implementation of internal and/or external business processes, SOA Maturity Level 4 focuses on measuring and presenting these processes at the business level so as to provide continuous feedback on the performance and business impact of the processes implemented at Level 3 (see Table 1 and Table 2).

Figure 9 shows an example process to configure, order and manufacture, with services for each key function distributed across geographic locations.

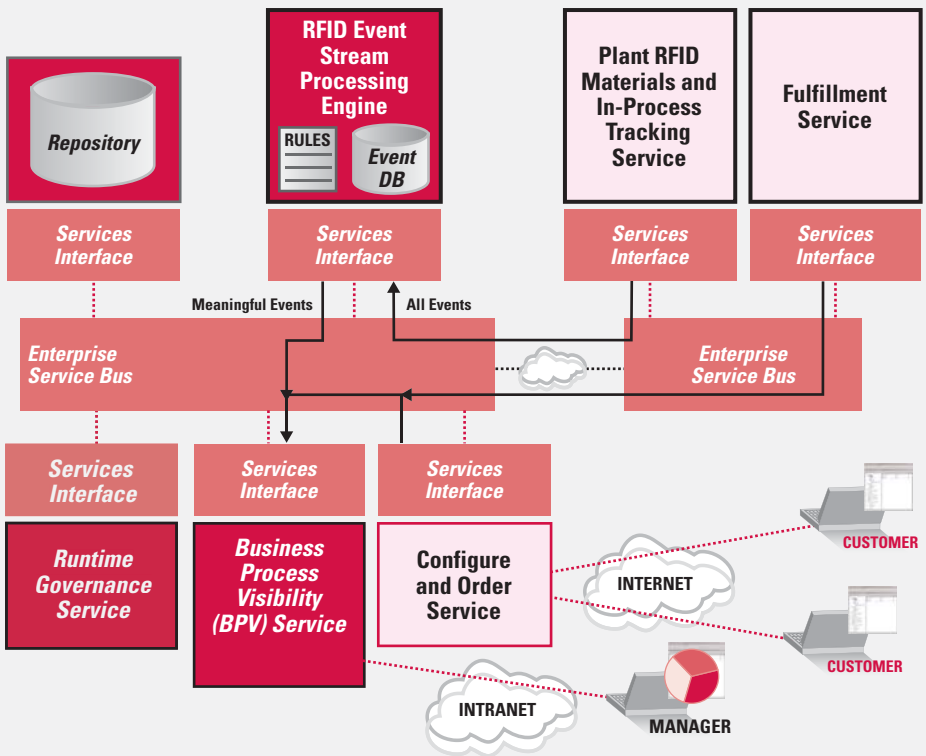
Key features in this example are:

- *Real-time Event Stream Processing* which in this example collects all RFID events into an event database and filters out the business-meaningful events based on rules and forwards them on for use in other services. As explained in *The Power of Events*[12] and "Event Stream Processing—A New Physics of Software"[13], event stream processing and "complex event processing" allows the *transformation* of business processes from being reactive to being based on real-time intelligence.
- *Business Process Visibility* (BPV) which empowers you to manage your SOA from a business process perspective. BPV allows business and IT users to gain a comprehensive view of individual business processes and their supporting business services and IT infrastructure, while simultaneously enforcing policies at the business process level.

[12] Luckham, David, *The Power of Events,* Addison-Wesley, 2002.

[13] Palmer, Mark, "Event Stream Processing - A New Physics of Software", DM Direct Newsletter, July 29, 2005, http://www.dmreview.com/editorial/newsletter_archive.cfm?nl=dmdirect&issueid=20226.

Figure 9: Example Application for SOA Maturity Level 4: Measured Business Services

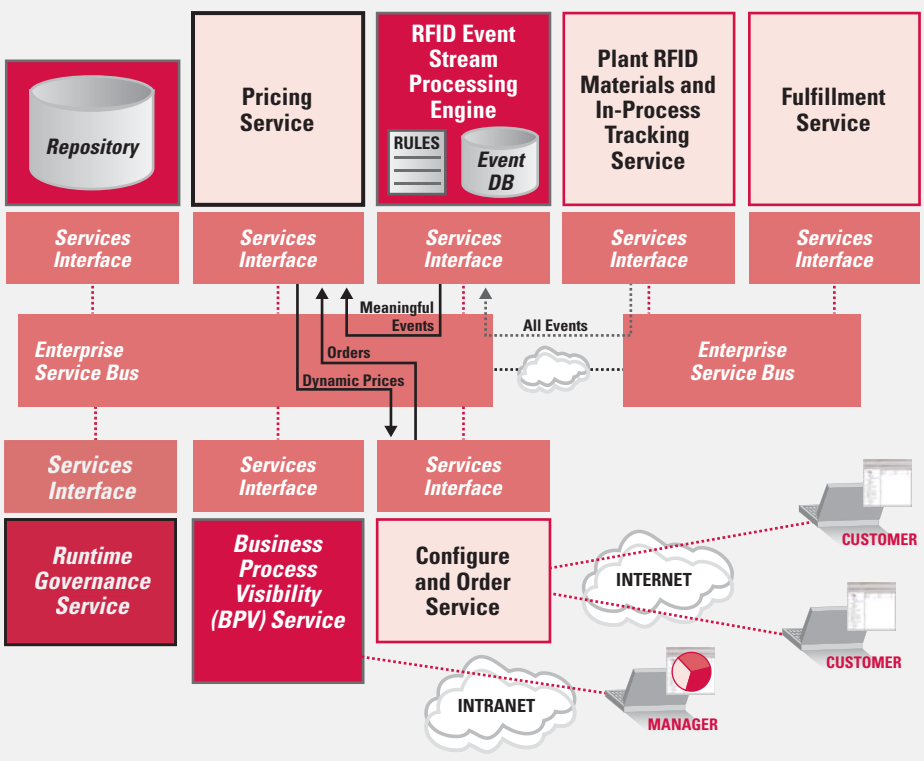


> 3.5 SOA MATURITY LEVEL 5 — OPTIMIZED BUSINESS SERVICES

SOA Maturity Level 5, Optimized Business Services SOA, adds automatic response to the measurements and displays of Level 4. In this way, the SOA information system becomes the "enterprise nervous system" and takes action according to events occurring at the business level according to rules *optimizing* business goals (see Table 1 and Table 2).

Figure 10 shows the configure, order and manufacture process enhanced to provide dynamic pricing according to the status of materials and in-process work in the manufacturing plant. For example, if parts for a particular version of an item are in short supply, pricing can be created to encourage purchasers to order an item using alternative parts. This example is inspired by the success of Dell Corporation's use of dynamic pricing in which a shortage of a particular capacity disk drive, for example, causes the dynamic creation of a special offer to encourage buyers to configure and purchase a computer with a larger drive.[14,15] Using SOA components allows such an approach to be more easily implemented and evolved than through the construction of proprietary systems. With realization of Level 5 Maturity, an organization should see true competitive advantage by leveraging in real time the flow of information within their enterprise SOA to increase revenues, reduce costs and respond to unanticipated events in an automated fashion.

Figure 10 — Example Application for SOA Maturity Level 5: Business Optimization

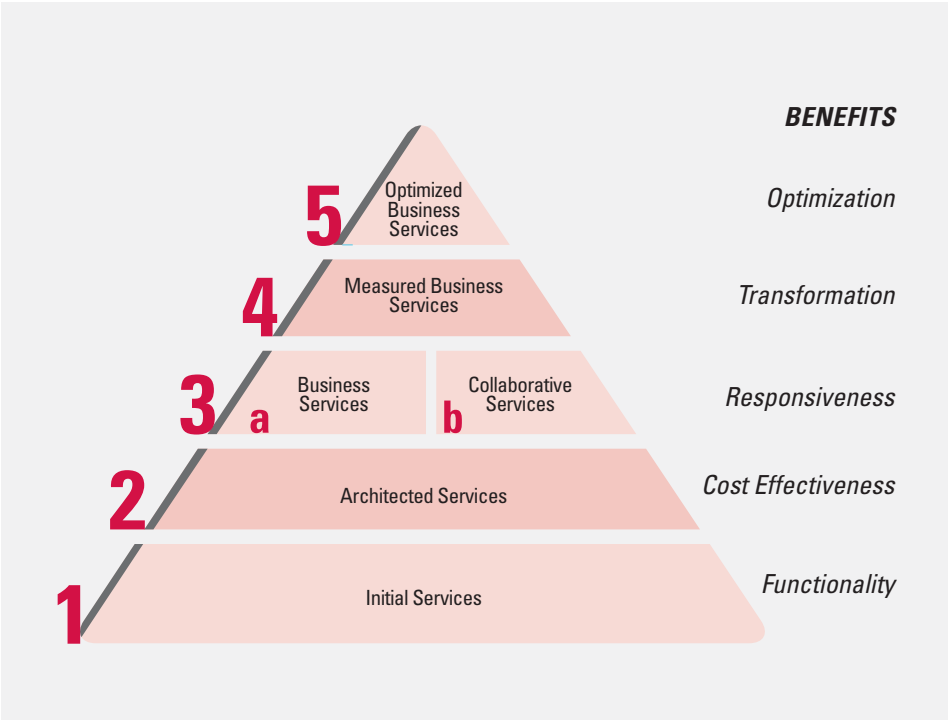


[14] Friedman, Thomas L., *The World is Flat,* Farrar, Straus and Giroux, 2005.

[15] McWilliams, Gary, "Lean Machine: How Dell Fine-Tunes Its PC Pricing to Gain Edge in a Slow Market", *The Wall Street Journal,* June 8, 2001.

> 4.0 CONCLUSION

The SOA Maturity Model provides a framework supporting both the vision and the assessment of increasing levels of business benefits from the adoption of SOA. The levels and key benefits are as follows:



Key to the success of SOA introduction and subsequent success is an evolving partnership between the technology and business organizations. This partnership is predicated on the ability for the technology organization to support the business in both responding to competition and in rapidly implementing new business models such as new distribution channels, new information services products and new pricing models—all with continuously improving metrics such as profitability and customer satisfaction.

The goal of SOA is to allow this business agility in a way different and better than previous technologies—different due to the capitalization on Web standards, due to the inherent flexibility of SOA design, due to the inclusion of legacy systems, and due to the availability of off-the-shelf SOA infrastructure and services. Ultimately, a company's success in achieving an increasing level of maturity will depend on the methodology and rigor that is either created within the enterprise or fast-tracked by engaging a systems integrator.

> APPENDIX: KEY CONTRIBUTORS

SONIC SOFTWARE

Sonic Software provides a full range of products to help organizations move through the Maturity Model and incrementally adopt SOA. Sonic's Enterprise Service Bus (ESB) is a core component for an intelligent, distributed, and scalable SOA communications infrastructure. Sonic Orchestration Server extends the intelligent routing capabilities of the Sonic ESB to enable the modeling, execution, and management of complex, stateful business processes across the extended enterprise. Sonic XML Server provides high-speed XML processing, storage, and query services for near real-time management of Sonic ESB in-flight XML messages.

REALIZING SOA MATURITY WITH SONIC

The following chart outlines how the Sonic products relate to each level of the Maturity Model:

Level 5: Optimized Business Services & Level 4: Measured Business Services	Business Optimization/Event Stream Processing through Progress® ESP™ Event Manager™, Progress® Apama® Algorithmic Trading Platform, and Progress® RFID
Level 3: Business Service and Collaborative Services	Business Process Management through Sonic ESB Processes (Itineraries) and Sonic Orchestration Server™ for sophisticated central process state management.
Level 2: Architected Services & Level 1: Initial Services	Foundation SOA functionality through SonicMQ®, Sonic ESB®, Sonic XML Server™, Sonic Database Service™, and Sonic Workbench™

ABOUT SONIC SOFTWARE:

Sonic Software is the inventor and leading provider of the enterprise service bus (ESB), a new communication and integration infrastructure that supports the enterprise requirements of a service-oriented architecture (SOA). Sonic's technology delivers the scalability, security, continuous availability and management capabilities necessary to connect, integrate and control distributed, mission critical business processes. Over 1,000 customers use Sonic products to achieve broad-scale interoperability of IT systems and the flexibility to adapt these systems to ever-changing business needs.

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ACTIONAL

Actional provides the runtime governance that is critical for realizing the return on investment from distributed, heterogeneous service-oriented systems. It can be used across the maturity levels with increasing functionality—from Initial Services through Optimized Business Services. Actional provides performance monitoring for Initial Services, ensures compliance with service level agreements and handles exceptions for Business Services, and monitors business activity for Measured Business Services. Through all levels of the Maturity Model, Actional delivers automatic dependency tracking to reduce system complexity and help organizations understand the impact of system changes.

REALIZING SOA MATURITY WITH ACTIONAL

The following chart outlines Actional capabilities at each level of the Maturity Model:

Level 5: Optimized Business Services & Level 4: Measured Business Services	Business Process Visibility (BPV) provides the monitoring and control mechanism to apply service and security policies to all steps within a business process across heterogeneous SOA infrastructure elements.
Level 3a: Business Services & Level 3b: Collaborative Services	Service level management, exception management and endpoint security. Automatic discovery of services and dependency mapping and tracking.
Level 2: Architected Services & Level 1: Initial Services	Basic performance monitoring and fault detection and notification.

ABOUT ACTIONAL:

Actional provides enterprise-class SOA management and runtime governance solutions to address the critical challenges of securing, governing and managing SOA environments. Leveraging leading technology and services, customers achieve the end-to-end transaction visibility required for performance, web services management and SLA adherence. Actional's proven solutions are designed for each stage of migration from Web services pilots to production SOA.

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PROGRESS OPENEDGE

Progress OpenEdge provides a flexible, reliable, and integrated platform for developing composite applications and their component services. At the core of this platform is Progress' Advanced Business Language, a 4GL that includes Object-oriented, procedural and data constructs in one easy to learn language. This language is married to the OpenEdge RDBMS, making the codification of data-intensive business logic very intuitive. This business logic can easily be manifested as web services and can readily consume web services to create composite applications.

OpenEdge also includes an array of tools that enhance productivity by abstracting away the complexity of developing on today's operating systems and deployment platforms. For example, OpenEdge Architect is an Eclipse-based development environment that simplifies development through enhanced automation.

REALIZING SOA MATURITY WITH OPENEDGE

The following chart outlines OpenEdge capabilities in the Maturity Model:

Level 3a: Business Services	OpenEdge OpenClient to reuse services in a variety of user interface paradigms (think-client, thin-client, character-based)
Level 2: Architected Services & Level 1: Initial Services	OpenEdge Architect (an Eclipse-based IDE), RDBMS and Application Server to create business logic and expose it as Web services.

ABOUT OPENEDGE:

The Progress® OpenEdge® product line is a comprehensive platform for the rapid development and deployment of business applications that are standards-based and service-oriented. OpenEdge can be deployed and managed over a wide range of computer platforms and across the Internet. OpenEdge provides a unified environment comprising development tools, application servers, application management tools, an embedded database, and the capability to easily connect and integrate with other applications and data sources.

Progress Software Corporation (Nasdaq: PRGS) is a US $405M million global software industry leader.

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DataDirect Technologies (previously Neon Systems)

DataDirect Shadow RTE product is a mainframe integration service which runs natively on the mainframe. It provides the foundation for standards-based bidirectional communications with mainframe applications. It supports Web services, real-time events, SQL access, and transactional, as well as providing auto generation of Web applications from mainframe screen-oriented systems.

REALIZING SOA MATURITY WITH DATADIRECT TECHNOLOGIES

Datadirect's Shadow RTE maps to the SOA Maturity Model as follows:

Level 4: Measured Business Services	Shadow RTE(Shadow z/Events)
Level 3: Business Services Level 2: Architected Services & Level 1: Initial Services	Shadow RTE (Shadow z/Services, Shadow z/Services WsC, Shadow Studio)

ABOUT DATADIRECT (NEON) TECHNOLOGIES

The acquisition of NEON Systems by DataDirect creates a leader in data connectivity and mainframe integration. NEON's Shadow RTE provides the industry's only single, unified platform for integrating mainframe data, Web services and real-time events. DataDirect Technologies is the software industry's only comprehensive provider of software for connecting the world's most critical business applications to data and services, running on any platform, using proven and emerging standards. DataDirect Technologies is an operating company of Progress Software Corporation (Nasdaq: PRGS—News). For more information, visit www.datadirect.com.

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