

The SOA Ecosystem

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Abstract: - Service-oriented Architecture (SOA) has gained considerable momentum in recent years, largely due to the advent of standards-based Web services that simplify interoperability, and governance technologies that make SOA scalable and predictable. SOA offers an easy way to speed time-to-market, respond quickly to changing business conditions, reduce duplication of effort and maximize the value of existing assets. When trying to leverage SOA, an understanding of the complexities and interrelationships of the SOA ecosystem is required. SOA ecosystem governance provides a means to ensure the quality, consistency, predictability, change and interdependencies of services. Its overarching goal is to manage the complexity created by SOA by ensuring that organizations are able to capitalize on the powerful promise of SOA without sacrificing control, predictability and efficiency. Managing the complexities of an SOA ecosystem is a major challenge for IT managers and the solution of this problem may be found in a full lifecycle approach SOA ecosystem implementations.

Key-Words: - Service-oriented architecture, SOA, Web services, interoperability, SOA ecosystem, governance, trust, visibility, control, SOA ecosystem lifecycle

1 Introduction

As a strategy for creating a flexible and agile IT infrastructure, Service-oriented Architecture (SOA) has gained considerable momentum in recent years, largely due to the advent of standards-based Web services that simplify interoperability, and governance technologies that make SOA scalable and predictable. Those organizations without a strategy for SOA risk being outpaced and outperformed by competitors that are better equipped to serve customers, seize opportunities and respond to change.

There are a number of business drivers for implementing SOA and some of the most outstanding include [1]:

- *Business Agility* – SOA makes IT more responsive to changing business demands, and more flexible to changing business processes. Reconfiguring loosely coupled business services is simple, fast and low-cost.
- *Cost Savings* – Organizations implementing SOA have the potential to achieve significant cost reductions by reusing sharable business services, rather than recreating functionality to address the needs of each application initiative. SOA simplifies and accelerates business application development, which enables organizations to do more with less.
- *Maximizing IT Investments* – SOA does not require organizations to rip and replace existing IT investments, but it allows organizations to

wrap and reuse existing IT investments and make them available to a wider audience. SOA encourages reuse and avoids unnecessary multiplication and reinvention.

- *Aligning IT to Business Processes* – SOA transforms IT systems into self-contained services that accurately reflect business processes and operational requirements. With SOA, IT mirrors business operations, which improves the utility IT delivers to the business.

This paper discusses the business value of SOA and introduces a management framework for implementing SOA and capitalizing on the advantages it promises. It reviews the critical elements of visibility, trust and control in implementing SOA, provides a context for understanding the SOA ecosystem, explores the importance of governance, and reviews the basic principles of governing SOA.

2 The Business Value of SOA

The Service-oriented Architecture (SOA) is a design style for maximizing IT interoperability, and for sharing and reusing business services in a distributed environment. Service orientation is not a new approach to software design, but it has become increasingly viable because of the widespread adoption of Web services technology that makes creating an SOA practical and cost effective [2]. SOA offers distinct advantages over traditional architectures.

SOA makes interoperability an innate characteristic of IT applications. Applications built using SOA-based services become *shared* resources that are completely platform-independent, language-independent and very loosely coupled based on universally accepted industry standards. Organizations no longer need to invest inordinate amounts of time and resources writing custom adapters to integrate applications, only to have to recode them when changes are made to support new business processes. With an SOA, all IT systems have interoperable applications, so the problem of integrating them becomes far less relevant.

SOA makes IT more agile and more responsive to changing business demands. New business processes can be supported and integrated across organizational and IT systems when needed and organizations can easily compose reusable, shared services to respond to new business challenges. In addition, since services are represented in high-level *business* terms, IT is encouraged to think in terms of business functions. With SOA, IT systems quickly adapt to organizational goals and processes. SOA makes IT highly tolerant of change and reconfiguring loosely coupled services becomes a simple and economical process.

Overall, SOA offers an easy way to speed time-to-market, respond quickly to changing business conditions, reduce duplication of effort and maximize the value of existing assets. The result is a very positive effect on the bottom line. Organizations can implement SOA initiatives and IT managers can better prepare their organizations to [3]:

- *Respond to Change* – SOA enables organizations to rapidly respond to unpredictable changes within the business environment, such as competitive assaults, mergers and acquisitions, reorganizations and new channel opportunities.
- *Differentiate* – SOA allows companies to differentiate their offerings by developing innovative, value-added services, such as a customer-facing tools and applications.
- *Drive Revenue* – SOA enables organizations to drive incremental revenue by simplifying the process of selling through new channels or enabling single views of data to support cross-selling initiatives.
- *Mitigate Risk* – SOA enables organizations to mitigate risks by ensuring corporate, IT and regulatory compliance by enforcing policies enterprise-wide within an operating environment.

3 Guidelines for SOA Development

As an organization begins planning for SOA, there are a number of things to bear in mind. IT managers should

consider the following guidelines as they approach an SOA rollout:

- *Planning for Incremental Deployment* – A complete conversion to SOA principles and practices does not happen overnight. SOA can easily be deployed incrementally and still show business value. For example, an SOA can show immediate value on projects with multi-point integration involving heterogeneous or legacy applications. Reuse of legacy code and integrating diverse platforms is an ongoing challenge for most enterprises, but that challenge is easily met using SOA [4]. A long-term plan with an overarching vision for SOA should be defined, but discrete projects should be particularly stressed to build momentum and show business value.
- *Focus on Interoperability* – Innate interoperability is a key benefit of SOA and it is important that interoperability standards are defined upfront and governed as business services are created and deployed. An organization must define an interoperability architecture and policy to manage all integration efforts. IT must also specify how services will be used and what standards must be defined and enforced. Organizations should also address the reference architecture for migrating point-to-point Web services to reusable business services.
- *Focus on Business and IT Agility* – Business and IT agility should always be a primary and overarching goal of an SOA strategy. IT systems begin to mirror business processes, making it easier to map business change to system change [5]. SOA technology makes it easier to implement IT change because systems are composed of loosely coupled business services. This means that changes in services do not interfere with connections between services, and reconfiguring processes is straightforward. For example, if the business rules for processing payroll are changed, the retirement plan system that depends on the payroll service is unaffected. The business services that compose an SOA represent a coarse-grained view of IT assets – i.e., it defines services around business concepts rather than technical details. This allows business analysts to easily understand and work with business services to implement change without turning to IT.
- *Thinking in Terms of Business Services* – At its core, SOA is about business services, which are the reusable components at the heart of an SOA. Business services represent a common unit of work – they are expressed in business terms and must be widely relevant and understandable to the

business. This defines the level of granularity for creating services. The right definition of business services is a key contributor to the success of an SOA and it shouldn't be overlooked [6].

- *Recognizing Broader Cultural Implications of SOA* – SOA dictates process and behavioral changes and initiatives cannot be successful if essential human factors are ignored. The two most significant cultural implications SOA introduces are *trust* and *incentives* [7]. Potential consumers of services will typically develop their own capabilities before they will reuse a service they can't explicitly trust. That is why the assurance of quality – and the proof of quality – are absolutely essential to the effectiveness of an SOA. Incentives are another cultural implication of SOA. SOA demands changes in the behavior of IT professionals who are used to creating and managing monolithic applications in highly siloed business settings. Developers need incentives to contribute services for reuse. IT and business line management need to implement incentive systems that encourage developers to think beyond their immediate business silo and contribute to the shared-service environment. This cultural change needs to come from the top, involving senior-level sponsorship of SOA, and it needs to be reinforced by processes and incentives that encourage compliance with an SOA style of development.
- *Thinking Beyond Web Services* – Some organizations confuse the use of Web services with a bona fide SOA initiative. The reality is that usage of Web services is only part of the picture. There are many services that are not necessarily Web-based but should be embraced by SOA arrangements. To quote the OASIS consortium Web site, "Web services can be used to implement SOA, but service orientation does not necessitate the use of Web services protocols, nor does the use of Web services protocols ensure that the overall system is SOA." [8] In other words, SOA implementations can benefit from the use of Web services, but it is not a given that one always comes with the other.
- *Understanding the SOA Governance Imperative* – In a traditional computing model, business functionality is buried in siloed applications and governance is hard-wired into the applications themselves [9]. SOA introduces a whole new dynamic and a fundamentally different governance model. Business functionality is exposed as standards-based, shared and reusable services, and governance is dictated by the application context, which is in a constant state of change. According to Gartner Group, "SOA

governance isn't optional – it's imperative. Without it, return on investment will be low and every SOA project out of pilot phase will be at risk." [10] This is because SOA introduces new levels of complexity that must be governed to ensure SOA does not turn into chaos.

- *Taking Human Relationships into Account* – SOA complexity comes in the form of relationships, both technical and human. Technical relationships involve issues of interoperability – services must interoperate with the applications they support and the other services and infrastructure they depend upon. But human relationships are at least equally important. Consumers and providers are at once both dependent upon one another and operating independently based on their own unique view of a service. Consumers and providers need complete transparency to avoid conflict and ensure a well-functioning relationship, but they also need the flexibility to work with the same services based on their own independent lifecycles. Since the specific needs of consumers and providers are rarely in alignment, they need a way to communicate and collaborate throughout the course of service usage. But trying to manage these relationships informally would be chaos, particularly because a provider will typically support many consumers.
- *Collaboration* – Collaboration must also occur throughout the process of business service definition, creation and implementation. Business people need to get involved in the definition of services to ensure they map to specific needs and process requirements. Application architects and developers are responsible for developing services. Enterprise architects typically define policies and oversee the implementation and operational aspects of business services. These are just a few examples of the many participants involved in managing an SOA. Again, this collaboration cannot happen informally for an SOA to function effectively.

4 Visibility, Trust and Control

An effective SOA is a marketplace of services, bringing together providers who publish services with consumers who discover and reuse services to develop new applications [11]. But the reality is that like any marketplace, governance is required to create an effective, smoothly functioning and effective operation. At its most basic level, SOA governance is about ensuring *visibility*, *trust* and *control*.

4.1 Visibility

Consumers need to be able to find and understand services to gain insights into their intended functions, attributes, characteristics and operating performance to help them make better and more informed decisions. Additionally, other IT stakeholders need to understand a full breadth of information about these services to manage the overall health of an SOA.

Questions these stakeholders may need to ask include:

- How many and which consumers are using this service?
- What is the impact of a service change on these consumers?
- To what extent does a service conform to specific IT, business and regulatory policies?
- Where is this service in its lifecycle?

To provide this visibility, organizations need a single “system of record” that captures all of the information about the business services at the heart of an SOA. This information includes service descriptions, policies, technical documents such as WSDL documents and schemas, contracts and other metadata that help consumers to fully understand the intent, operational realities and the trustworthiness of business services.

4.2 Trust

A significant challenge to SOA adoption is that while the management of service quality is paramount, simply having quality is not enough. For the first time, quality must be proven and demonstrable to consumers to gain their trust and create an effective shared-service environment. Without trustworthy services, consumers will typically recreate rather than reuse, which undermines the overall purpose of an SOA. Creating a system of record enables organizations to capture the information necessary to create a “trust profile” that makes the quality and trustworthiness of a service visible and apparent to consumers.

Another aspect of trust is the ability to formalize consumer/provider relationships with an enforceable agreement that specifies service level expectations and any other terms, conditions and details that need to be agreed upon as the basis for service consumption. An informal consumer/provider relationship can easily lead to conflict and misunderstood needs and expectations, which can create inefficiencies and potentially disrupt applications and business processes.

4.3 Control

Organizations need to manage services just as they manage other high-value IT assets – from introduction to

final retirement and at every step in between. This means managing access to services, ensuring they are visible and accessible to only authorized stakeholders. It also means enforcing specific processes for service introduction.

Processes must be defined and people identified for reviewing and authorizing the introduction and publication of new services to minimize duplicate, nonconforming or poorly defined services and to assess overall fitness for use. Control is also about service change. As services evolve, organizations need to be able to anticipate the impact of changes to ensure modifications to a service do not disrupt other services and applications where dependencies exist.

5 Understanding the SOA Ecosystem

When trying to leverage SOA, an understanding of the complexities and interrelationships of the entire *SOA ecosystem* is required [12]. It is important to recognize that no single vendor can deliver something like “a complete SOA solution.” The reality is that many software vendors *participate* in the SOA ecosystem, and IT managers need a framework for analyzing the role a vendor can play in the creation of an SOA.

The SOA ecosystem involves a number of components, such as:

- Data Sources
- Integration Layer
- Business Logic Layer
- Orchestration Layer
- Presentation Layer
- Infrastructure Services
- Governance
- Management & Security

Data Sources consist of packaged or internally developed legacy applications, and they contain the data and the functionality that organizations will often want to repackage and expose as reusable services.

Integration Layer provides an intermediary to the underlying data that needs to be accessed and shared within an SOA. Organizations typically introduce this layer when they have large-scale requirements and need to maintain consistent performance and response times; or when they need to transform or otherwise enhance data. This layer typically includes technologies such as enterprise application integration (EIA), enterprise service bus (ESB) and enterprise information integration (EII).

Business Logic Layer consists of the commercial software applications that were developed based on a set of reusable and self-contained services that can be combined and composed to meet the specific needs of an organization’s business processes. This layer represents

the new paradigm for commercial software development and delivery, and will often figure prominently into an enterprise SOA strategy.

Orchestration Layer provides the tools for creating applications, defining workflows and assembling business processes. The orchestration layer is the focus of the business process management (BPM), workflow, business activity monitoring (BAM) and business rules vendors, and it is where IT and technically oriented business analysts assemble SOA-based components to build new applications.

Presentation Layer is how services and the applications they comprise are displayed to end-users. Examples include Web portals, composite application frameworks, mobile devices and PDAs.

Infrastructure Services are the tools and technologies that “keep the lights on.” These services include capabilities for user provisioning, ensuring security and managing identity, as well as capabilities for application testing, monitoring and management to ensure services

meet functionality, performance and availability requirements.

Governance includes a trusted and authoritative *system of record* for the discovery of services, capabilities for managing collaboration between technical and business stakeholders in an SOA, tools for ensuring the quality and conformance of services, and capabilities for formalizing consumer/provider relationships [13]. SOA governance is centered on ensuring visibility, trust and control.

Management & Security includes Web service management (WSM) and XML security vendors. WSM focuses on enforcing policies within an operational environment to permit conforming and reject nonconforming service behaviors at run time [14]. XML security encrypts and secures XML-based messages “over the wire” to ensure data is secured end-to-end and to preclude packet spying and sniffing.

The SOA ecosystem is schematically presented in Figure 1.

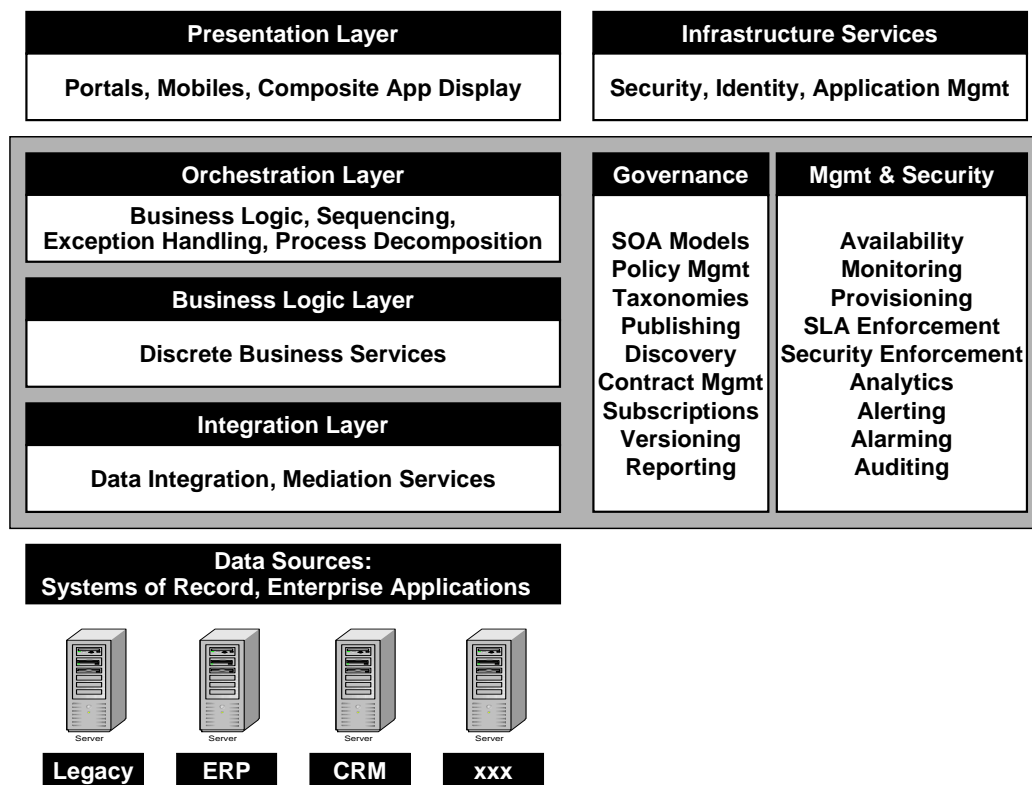


Fig. 1 – The SOA Ecosystem

6 Governing the SOA Ecosystem

The SOA ecosystem governance consists of the corporate, as well as internal and external business and IT processes and rules required to control and guide the business success of an SOA ecosystem implementation.

SOA ecosystem governance provides a means to ensure the quality, consistency, predictability, change and interdependencies of services. Its overarching goal is to manage the complexity created by SOA by ensuring that organizations are able to capitalize on the powerful

promise of SOA without sacrificing control, predictability and efficiency. Said another way, SOA ecosystem governance is about *blending* the flexibility of service orientation with the control of traditional IT architectures.

While governance is critical to the success and viability of an SOA initiative, it represents but one important piece of the puzzle. The SOA ecosystem is at least as much about people and process as it is about technology. But even in the narrow scope of technology, organization should beware of vendors who claim to have a “complete solution” for SOA – no single vendor can deliver on such a lofty claim. The SOA ecosystem is inherently heterogeneous, involving both existing “legacy” technology as well as point solutions from a number of different vendors. As such, organization must evaluate interoperability and look for deep partner networks when selecting commercial software vendors.

The promise of SOA cannot materialize unless organizations ensure visibility, trust and control within their SOA. This means creating a foundation for SOA governance that balances the flexibility and agility promised by SOA with the control and predictability of traditional IT.

But, while governance is generally accepted as the starting point for scalable SOA initiatives, many organizations are now realizing that they must take a full lifecycle approach to managing their SOA ecosystem implementations. This means that, in addition to ensuring visibility, trust and control, there must be broader considerations for testing functional and performance aspects of services and monitoring the behaviors of services within an operating environment [15].

7 Conclusion

SOA makes IT organizations more flexible to respond to evolving business demands. SOA presents a tremendous opportunity for IT managers to help organizations respond to changing business conditions, differentiate their offerings, increase revenue and mitigate risks by ensuring corporate, IT and regulatory compliance by enforcing policies enterprise wide. But the reality is that SOA itself can introduce new risks that must be managed by starting with a foundation for governance. This enables organizations to capitalize on the promise of SOA without creating an uncontrolled and uncontrollable IT environment.

IT managers are increasingly leading SOA initiatives, and it is critical to ensure governance so that SOA environments can be managed and scaled over time to ensure a functioning marketplace of services for SOA consumers and providers. SOA can help IT management transform their businesses, but successful deployment of

SOA requires governance based on visibility, trust and control. Managing the complexities of an SOA ecosystem is a major challenge for IT managers and the solution to this problem may be found in a full lifecycle approach to SOA ecosystem implementations.

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