

View Point



SOA: A Perspective on Implementation Risks

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Abstract

Enterprises are gravitating towards Service Oriented Architecture (SOA) to re-design their IT for the future. As with all other technologies, the adoption of SOA involves risks. These risks often manifest themselves during an SOA solution implementation and arise primarily due to insufficient detailing in the design of SOA. This paper identifies some of the risks across different viewpoints of an overall SOA-based Enterprise Architecture. Awareness of these risks can help designers and architects put in place appropriate measures to continuously evaluate and mitigate them.

Introduction

Service-Oriented Architecture (SOA) is no longer a mere buzz word. It is slowly moving into the mainstream. Researchers expect that, by the end of 2006, 67% of the firms with 40,000 or more employees are likely to start implementing SOA. Already, 44% of the SMBs (Small & Medium Businesses) have highlighted the criticality and priority of SOA implementation for them¹.

What should an enterprise do to adopt SOA? As with any other architecture/design philosophy, an SOA implementation depends a lot on interpretation. It dictates the real values an enterprise can get out of SOA. Whether to start SOA sporadically across various projects or to take the high-value route of strategic enterprise adoption of SOA is an enterprise decision. However, the second path is not a simple one as it involves re-architecting the entire IT organization around business services.

Strategic enterprise adoption of SOA typically happens in two high-level phases –

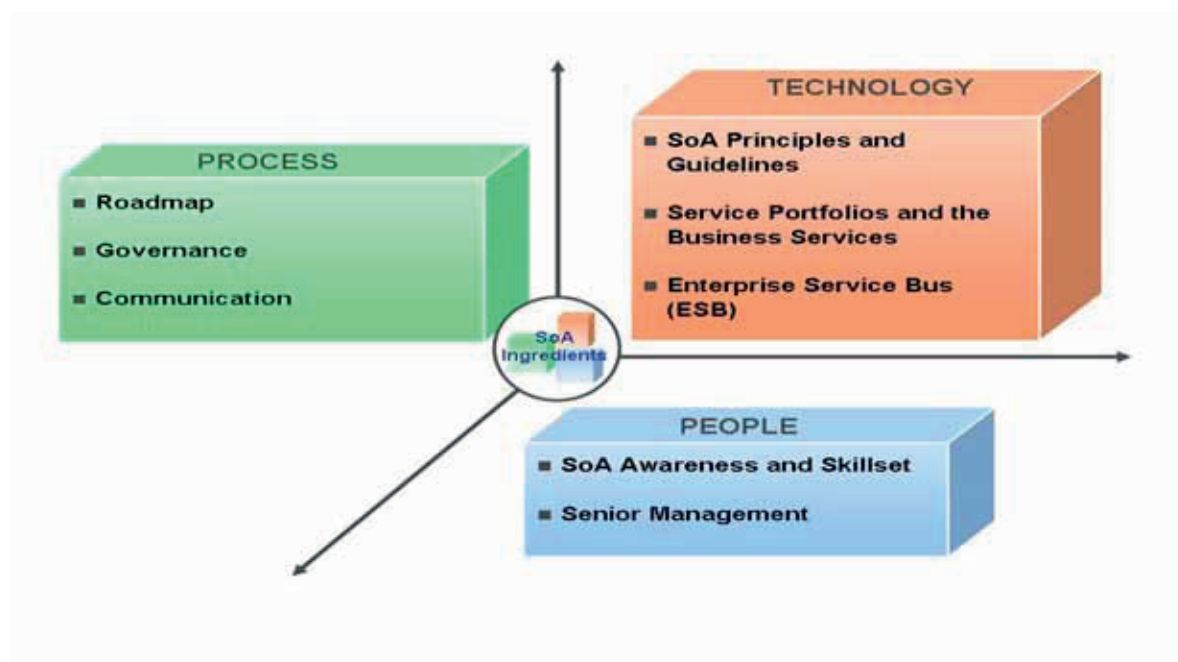
- SOA solution definition
- SOA solution implementation.

In the solution definition phase, high-level decisions are taken and essential guidelines finalized across different dimensions of the SOA program. They provide the framework for the implementation phase and shape the final state of the enterprise SOA environment. It is very expensive to change these decisions and guidelines at a later stage.

In this paper, we take a close look at the risks that typically surface in the SOA implementation phase due to shortcomings in the SOA solution definition. Awareness of these common risks will make the SOA solution definition phase more effective and comprehensive, and will also contribute to the success of the SOA program.

Key Ingredients of an SOA Solution

Like all other strategic initiatives, SOA initiatives also have some key ingredients that are almost invariant to different business contexts or scenarios. In the diagram below, a set of key SOA ingredients are presented along the dimensions of Technology, People and Process. These ingredients quantify ‘what is SOA?’ and create some artefacts that can support implementation and use of SOA-based services. Their importance and relevance may vary from business to business, but as a best practice for building SOA solutions all these ingredients should be considered carefully. Otherwise, these ingredients can become the prime contributors to the risk elements in SOA implementations.



Technology

SOA has its share of technology standards, principles and best practices. The key technology ingredients of SOA are:

SOA Principles and Guidelines – They are the highest level of technology considerations for SOA. They are typically derived from business drivers, and industry standards and best practices (e.g. use of Web Services). SOA principles and guidelines come handy while dealing with aspects like conflict resolution. However, most SOA standards are still emergingⁱⁱ — that means unless they are adopted and used carefully, they can lead to complications.

Service Portfolios and Business Services – Today, most SOA architects understand the criticality of ascertaining granularity of business services for an enterprise and clubbing them effectively into service portfolios. Enterprises must first develop a framework for service identification and clubbing, then define and implement services based on the framework, and finally, fine tune the framework for further use, based on the learnings. The framework must correctly define/adopt the business semantics applicable to the business service.

Enterprise Service Bus (ESB) – The ESB, whether custom-built or based on commercial products, is the heart of any SOA solution. Without an ESB it is difficult to have a truly scalable and adaptable SOA solution. ESB provides some of the key features needed by any SOA, namely Service Registry, Transformation Component, Routing Mechanism, Policy based (security implementation) Configuration Environment, and sometimes, even adapters to take care of the varied technology platforms in the enterprise. So creating/customizing an appropriate ESB tuned to the need of the enterprise is essential. However, it is seen that today most of the ESB products don't follow any standardⁱⁱⁱ.

People

No SOA solution definition can be comprehensive without addressing the people aspects in it. Some of the aspects are:

SOA Awareness and Skillset – SOA being a fairly new concept, a lot of hype and myth is still associated with it. Awareness of the real characteristics of SOA, and the skill to identify and apply them at different levels are a must for technology decision makers as well as implementers. Incorrect understanding can jeopardise an entire SOA initiative.

Senior Management Support – The requirement for Senior Management Support may sound obvious considering the scope of an SOA program. But, it needs to be restated given the fact that it usually takes a long period for any SOA initiative to demonstrate quantitative benefits. Like other technology transformation programs, SOA needs support from the senior level to ensure continued participation of all stakeholders across the organization. And the support should be built during SOA solution definition phase itself.

Process

SOA implementations, typically, span the entire enterprise and involve a number of internal departments, partners and stakeholders. There must be strong processes to manage the large scope of an SOA solution. Key process ingredients are:

Roadmap – Business and IT teams need to work jointly on the roadmap for an SOA implementation. It is not easy due to the large scope of work and the magnitude of impact. The details of the roadmap must instil confidence on the success of the initiative among all stakeholders. Generally, as-is and to-be scenarios in business, technology, operations, and other impacted areas are used to draw an overall picture of the required changes and their complexities. The roadmap is then prepared to bridge the gaps, taking into account the short-term and long-term needs. The challenges lie in preparing a plan that provides tangible business benefits on a continuous basis over the entire period of the SOA program (to keep the funding for SOA program flowing), and aligning the short-term gains with the long-term benefits.

Governance – SOA, being a technology transformation program, needs a strong governance model that encompasses every layer and every interaction in an SOA implementation. How do you resist the temptation to implement a product in a non-SOA path due to time constraints? How do you ensure that maintenance teams do not apply quick fixes, thus defeating the purpose of the initiative? How do you ensure that your vendors' level of SOA compliance is satisfactory? All these issues must be addressed by the governance model. The extent of governance and policing needed and the people responsible for it is debatable.

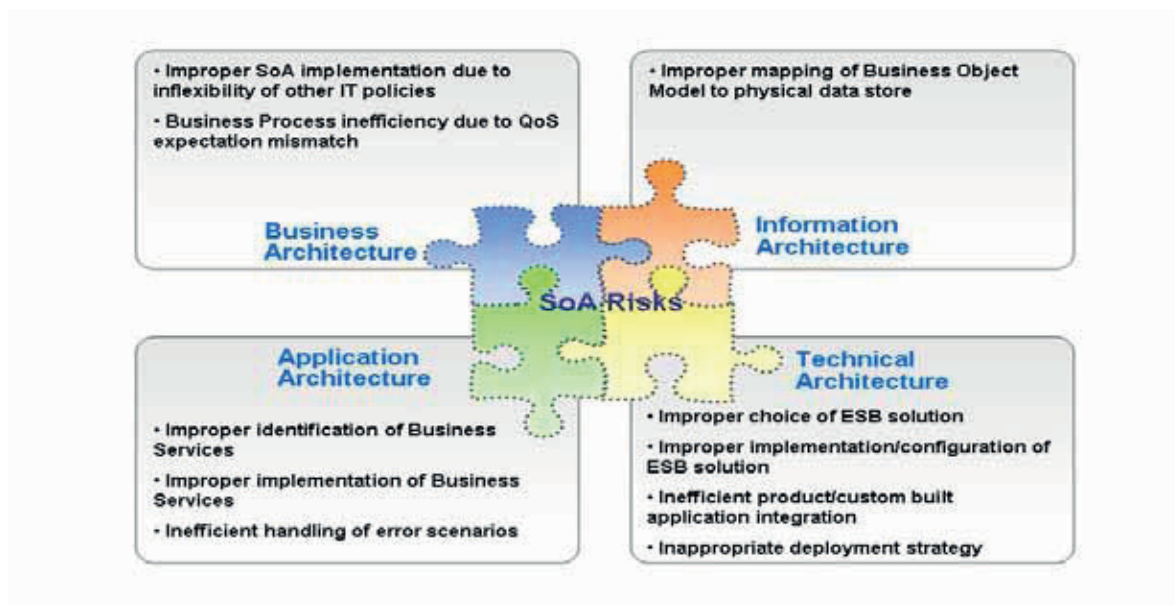
In large enterprises, the bifurcation of roles and responsibilities between central and in-house IT functions is a big challenge to SOA governance. SOA governance should follow a more centralized model than the traditional shared services for IT applications^{iv}.

Communication – As an enterprise-wide program, SOA has its share of challenges in requirements management, knowledge management, resource management, perception management, vendor management, change management, etc. An effective communication process is a must to take care of all these aspects of the program.

Risks in SOA Implementations

Usually, risks arise from reasons rooted in the SOA solution components. If the components are not defined and detailed carefully during the SOA solution definition phase, they are difficult to modify at the implementation stage. Besides, they can eventually affect the quality, cost and timeline of the final deliverable from the overall SOA initiative.

We have identified these risks across the different viewpoints of an overall SOA-based Enterprise Architecture, using TOGAF 8^v as reference.



Business Architecture Risks

Improper SOA implementation due to inflexibility of other IT policies: While designing/implementing SOA, architects and solution designers often face constraints due to other enterprise IT policies. IT policies govern enterprise-wide initiatives by aligning them to a single set of corporate goals. SOA, being a new way of looking at the things (in some cases, a paradigm shift from past approaches), requires the flexibility to revisit policies that are legacies of a different environment. Compromises made to accommodate inflexible policies can, sometimes, cause SOA to be abandoned midway. For example, a stringent security policy to invoke domain-specific modules across internal (intranet-based) applications can inhibit SOA implementation by impacting performance and scalability. Also, the use of technologies that are essentially against the principles of layered architecture, e.g. stored procedures, can change SOA into a monolithic architecture. The root causes for this risk are:

- Mandatory standards not clearly identified by the SOA principles and guidelines
- Lack of senior management support to push the mandatory SOA principles and guidelines and align them with other policies
- The roadmap does not identify possible conflicts with other IT policies, thus there is no planning for aligning the policies with SOA principles
- SOA governance process does not provide guidelines to handle conflicts with other IT policies, should they arise during the implementation phase
- Lack of effective communication with other policy makers to convince them about the need for change

Business process inefficiency due to Quality of Service (QoS) expectation mismatch: Often, the QoS requirements of individual applications are just extended to the overall business process, instead of considering the actual need of the business processes and deriving the QoS requirement for each component/service/layer from there. This creates an actual-expectation mismatch in the end. The root causes of this risk can be:

- Lack of effective communication between the business and IT people while capturing the overall QoS requirements for different business process scenarios
- Lack of business process QoS modeling and testing in the roadmap
- Absence of governance activities for controlling QoS aspects of the business process

Application Architecture Risks

Improper identification of business services: The quality of an SOA solution can get affected if the identification and mapping of business services and service portfolio are not driven and monitored by a central body. This will eventually impact the overall extensibility and maintainability of the SOA solution. This is particularly true in situations where many implementation partners — external and internal, are involved. The root causes for this risk are:

- SOA principles and guidelines not providing enough/appropriate direction for identifying and implementing business services
- Lack of SOA awareness and skills, and the selection committee's limited knowledge of SOA products

Improper implementation of business services: Even if business services are identified at the right level of granularity, unless SOA principles and guidelines are followed during implementation, there can be problems with flexibility, maintainability and performance. For example, often it is perceived that every business service has to be implemented as a Web Service. However, for some business services, this may only add to the performance overhead of the overall business process and not deliver any real benefit. Improper implementation of business services takes place due to:

- Selection of an SI partner with limited exposure to SOA, which may be due to a lacuna in the governance process
- SOA governance process does not include a review process at service implementation level
- SOA principles and guidelines do not provide the necessary framework for service implementation

Inefficient handling of error scenarios: Lack of a coherent strategy, in terms of processes, guidelines and standards, to manage an error situation can cause difficulties. Lack of data integrity, re-startability, etc in error/outage scenarios can make end-users sceptical on the reliability of the system. Moreover, in the absence of a high-level strategy, there are chances of different error-handling mechanisms evolving at each component level. Inefficiency in interpreting/debugging errors, data recoverability, and re-startability of the process at the overall system level can eventually affect the availability of the system. The causes for this risk can be:

- Absence of sufficient inputs from SOA guidelines and principles for defining the error handling strategy and the need for it
- Absence of step for defining high-level error handling strategy in the roadmap

Information Architecture Risks

Improper mapping of the business object model to the physical data store: While defining an SOA solution, the business object model can be easily derived from the business service definition by applying rules of normalization. However, very often, people resort to one-to-one mapping of an object to a data store for the physical data store design. This leads to sub-optimal and inefficient designing. Instead, it should consider the navigation and access path, requirements of archiving and retention, regulatory requirements, reporting requirements, data volume, etc. Inefficient business object to physical data store mapping can give rise to performance and flexibility issues. This risk is caused by one or more of the following:

- Absence of governance activities, e.g; insufficient reviews by experts during the physical data store design
- Lack of skills to convert SOA-based business objects to physical database design
- Ineffective communication between the SOA architect and the database architect

Technical Architecture Risks

Improper choice of ESB solution: The concept of SOA is prone to misinterpretation and misuse due to ignorance as well as vested interest of different bodies / organizations involved. A vendor may try to fit in a non-SOA ready/compliant product/platform to the overall solution forcibly just to sell the licenses of the product. Sometimes, a non-standard based product (which may not even have roadmap for aligning with standard) may get considered as an SOA implementation building block due to savvy marketing tactics by vendors. This can impact extensibility and maintainability of the solution. The root causes of this risk can be one or more of the following:

- Improper product selection due to lacuna in governance process
- SOA principles and guidelines not providing enough/appropriate direction to decide criteria for product selection
- Lack of SOA awareness and skills, and the selection committee's limited knowledge of SOA products

Improper implementation/configuration of ESB solution: ESB solutions normally come with many configuration options and can support a variety of implementation scenarios. Not all configurations/implementation scenarios are right for the SOA philosophy. Unless the ESB solution is used properly, the benefit of SOA may not be reaped fully. It can also result in the lack of flexibility and maintainability of the overall architecture. This risk can be the result of:

- SOA principles and guidelines not providing enough/appropriate direction for the ESB configurations/implementation approach
- Selection of an SI partner with limited exposure to SOA, which may be due to a lacuna in governance process
- SOA governance process does not include review process at the service implementation level

Inefficient product/custom-built application integration: Different partners engaged for delivering work products related to different threads and components of the overall SOA program can be a source of integration issues at later stages. The reasons can range from non-availability of required documentation for a partner's product to the absence of appropriate work break-up and interface contracts for different partners. This will affect the cost and timeline of the implementation. It can even force a compromise on other QoS attributes of SOA, if timeline and cost are constraints. The causes for this risk:

- SOA governance process not providing enough guidelines on partner integration
- Lack of effective communication across partners
- A roadmap that is not detailed on integration dependencies and milestones
- SOA principles and guidelines do not provide enough inputs on partner service procurement process. It has been found that the use of conventional service procurement process may not be proper for engaging multiple partners for developing/providing service orientation of existing components/functionality^{vi}.

Risk related to inappropriate deployment strategy: While implementing an SOA, deployment design needs special consideration due to the usage of services by external as well as internal systems and the high abstraction of data exchange in terms of services. The considerations of special importance are availability, security and scalability. These aspects have to be translated from the high-level SOA guidelines and principles, but very often there are gaps that render the deployment design inappropriate for a service-based information exchange. This risk can creep in due to the following reasons:

- Absence of enough inputs in SOA guidelines and principles for defining the deployment design
- Ineffective communication between the SOA architect and the infrastructure designer
- Absence of governance activities like sufficient reviews by experts during the deployment design, etc

ⁱ Topic Overview: Service Oriented Architecture, Randy Heffner & Larry Fulton, Forrester Research Inc, May 2006

ⁱⁱ Emerging SOA Standards: SCA/SDO And JBI Multiple Alternatives Aim To Ease SOA Implementation, Mike Gilpin, Forrester Research Inc., March 2006

ⁱⁱⁱ <http://www.theserverside.com/tt/articles/article.tss?l=ESBParadigm>

^{iv} http://webservices.sys-con.com/read/175389_1.htm

^v <http://www.opengroup.org/architecture/togaf8/index8.htm#top>

^{vi} <http://www.forrester.com/Research/Document/Excerpt/0,7211,39194,00.html>

Conclusion

In this paper, we have studied how improper definition and insufficient detailing of the solution can give rise to many risks during an SOA implementation. These risks must be factored in while planning the solution definition. Also, during the implementation stage, a risk mitigation plan must be in place. An important aspect: The key ingredients, though studied here in isolation, are interdependent and can impact each other during implementation. This makes risk evaluation a heuristic process.

About the Author

[Sourav Mazumder](#) is a Principal Architect at Infosys, with 10 years of experience in the IT industry. He has worked on projects dealing with internationalization and multi-byte characters, especially dealing with East Asian characters. He has also worked in different phases of typical i18n projects, from byte-level trouble shooting to technical consultancy to clients in their i18n initiatives.

Sourav is an iCMG certified Software Architect as well as TOGAF 8 certified practitioner.



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