

## White Paper



### Connecting the dots: Cloud and SOA

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#### Abstract

How is SOA connected with cloud computing? What is the relevance of SOA to cloud and how is it applicable? These are often asked questions in perspective of cloud as a service oriented model. SOA is fundamentally an architecture framework that can be used in designing and implementing a cloud. SOA helps to build a shared platform and can be used to provide the envisaged services.

## Introduction

Information technology is slowly and steadily moving from a *traditional-support model* to a more contemporary and *business-oriented services model*. The demand is to have anything and everything as a service that can be used on a per-usage basis. Increasing requirements for agility, optimized usage, and availability, combined with the ever-green mantra of cost-reduction, have fuelled the growth of service oriented approach. There have been many such models in the past – utility computing, grid computing, and, a new entrant into this spectrum, is cloud computing. Cloud provides everything as a service, aiming to provide a more agile, scalable, and cost-effective infrastructure and application platform to the customer.

Service Oriented Architecture (SOA) is another concept which has influenced IT architectures in recent times. It is a framework, if deemed so, that promotes the use of shared model of resources – processes, applications, and data – that are improved with abstraction. SOA exposes and allows access to well-defined services (as well as information bound to those services), and then abstracts them to modular layers, which helps in application development, reuse and ease of integration. . In short, SOA intends to bring in agility to the IT architecture. However, SOA rarely figures in the discussions related to cloud computing. This brings across two important questions - Should SOA emerge in cloud-related discussions? Is there at all a relationship between SOA and cloud or is it only a couple of co-incident ideas?

## SOA meets Cloud

Cloud computing represents an “elastic” and “malleable” IT fabric or a platform, which is exposed over the internet and enables enterprises to use their resources and services to the maximum potential. Cloud allows businesses to expand or contract the IT footprint, based on existent demand. It also provides a platform for developers to build customized applications. In cloud computing, infrastructure components are provided as hardware elements, software are provided as web services, applications (and toolkits) are exposed as APIs to the outer world. These elements, in turn, leverage and build a complete or partial IT landscape on cloud. Over the existing hardware, software, and application layers there is a nuance of management, governance, and processes. The success of a cloud-model depends on its ability to multi-tenant combined with the necessary information security. In all of this, there is an underlying realm of re-use and service orientation that runs throughout; and it is at this realm where SOA supports cloud at the first instance.

At the crux of it, SOA defines architectural principles for enterprise systems by defining interfaces, processes, and communication between various sub-systems, by focusing on predictable patterns and service behaviors. SOA encompasses a library or a repository of service components and processes that a service consumer can invoke. At a higher-level of encapsulation, SOA is a set of services collectively termed as web services, which are actually standards such as SOAP, REST, WSDL, and so on. SOA advocates the principles of component reuse and a well-defined relationship between a service-provider and service-consumer. SOA enables the recurring use of existing application functionality and attempts to share common information, services, and processes across the organization. Figure below indicates how SOA and cloud overlap.

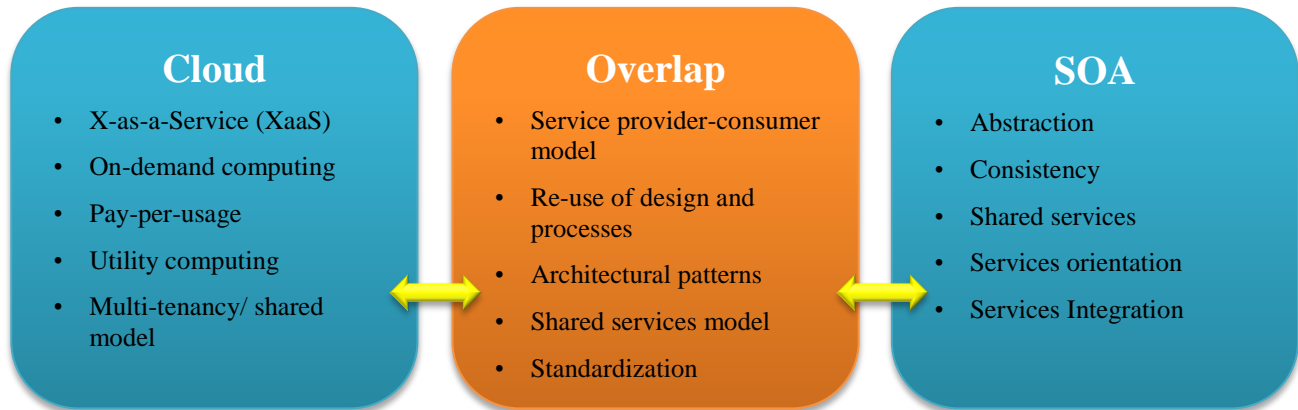


Figure 1: Cloud and SOA overlap in more than one architectural way

By understanding the high-level definition of cloud and SOA, it is easy to plot the relationship Venn diagram between the two. Though there are a few cohesions between them, SOA principles immensely help cloud computing architecture to deliver the required services model with agility and scalability.

Services Integration is a key aspect of cloud computing, and is not limited to infrastructure or applications running over it. The recognized success of a cloud model lies in how well it integrates with various other services, within and outside of the cloud realm. Integration between various IT infrastructure components (such as VM instances integrating with SAN devices), between various application and workflow components (such as messaging queues and usage of enterprise service bus), as well as between various service processes (such as Management and service delivery processes) are becoming a cornerstone in today's IT enterprise (both cloud and on-premise). This is one of the core architectural requirements of a cloud environment, and can even be termed as an essential component of cloud architecture. Also SOA streamlines this integration by defining standards for every interface and also, more importantly, applies consistency across multiple sub-systems. In most situations a cloud computing infrastructure is bound to be vulnerable when lacking two key characteristics - consistency and standard – that are prime tenets of SOA. These are in addition to the management characteristics such as governance, manageability, and so on which intersect SOA and cloud.

## Confluence of concepts

A cloud can be built and managed without the actual SOA practices, and also SOA can work without cloud. On the other hand, in order to realize the full potential and value of a cloud environment, it is essential to use the full range of services offered by what is popularly called as “somebody else’s datacenter” (read cloud). In a multi-tenanted and shared environment, it is recommended to define the overall architectural principles (including the process definitions) directly and unambiguously. David Linthicum, an avid SOA expert writes “Those who attempt to toss things to the clouds without some architectural forethought will find that cloud computing won't provide the value”.

The following table lists out a few perspectives advocated by SOA that can be implemented in a cloud.

What SOA preaches...?	... and how cloud tries to implement
<b>Standardization and re-use of components</b>	Virtual machine instances are built using standard template and provisioned for use. The template can be reused irrespective of the OS or the virtualization software.
	Similarly, in a PaaS environment the APIs are reused by developers to build interfaces and other service components. This enables standardization of the interface development and provides consistency
<b>The ability to monitor points of information or service, in order to determine the health of the infrastructure</b>	Cloud implementations provide component, service, process-level monitoring of the IT footprint, through management tools. Also such tools provide clouds with the necessary service management and orchestration capability.
<b>Architectural discipline</b>	Cloud environment, for its success, implements a well-defined and modular architecture at all levels – Infrastructure, applications, and so on. We can deconstruct the cloud SPI model to understand how every layer embraces a pre-defined architecture description, without which cloud will fail.

Table 1: Implementation of SOA, seen in practice

In multiple ways, cloud can be seen as an extension of SOA that goes beyond applications and into IT Infrastructure. IT components are increasingly being delivered as services, which has become the focus for IaaS and PaaS. This is truly a derivative of the SOA services. IT Infrastructure components, similar to their software counterparts, have become to be discovered, managed, and governed. Cloud computing can also viewed as the “cornerstone” that SOA was long awaiting for, that could see an increased adoption of SOA in the industry.

SOA for cloud starts within the enterprise. It is unreasonable to expect that applications and other services can be “tossed-up” into the cloud and provide exceptional results. SOA has to be undertaken for the IT enterprise even in an on-premise environment, where a framework is established for the IT Architecture, processes are defined and tools identified. This is often the starting point for implementing service orientation. It is recommended that entities that require to be fixed are best done within the organization, and before they move to the internet domain. Abstraction of various services and definition of solution for various application and business requirements need to be done within the organization, and the same implemented in cloud. Public cloud providers will be able to implement similar features in their implementations of cloud. In a broader perspective, the roadmap for implementing SOA on cloud is to start internally, build and test the processes, and finally move to cloud. *This is outlined in Figure-2 below.*

SOA is an optimum option for enterprises to solve issues of broken architectures, given the rapid growth of business requirements and divergence in application & solution development paradigms - especially with increasing usage of open source tools and frameworks. SOA patterns on Web Services have found quick acceptance and have matured; however, other areas are in the process of development. Given this background, we can conclude that SOA can also solve the architecture issues within cloud. However, as forethought, Cloud environment will find SOA very useful as a solid architecture platform and process definition architecture, which are critical for the success of cloud.

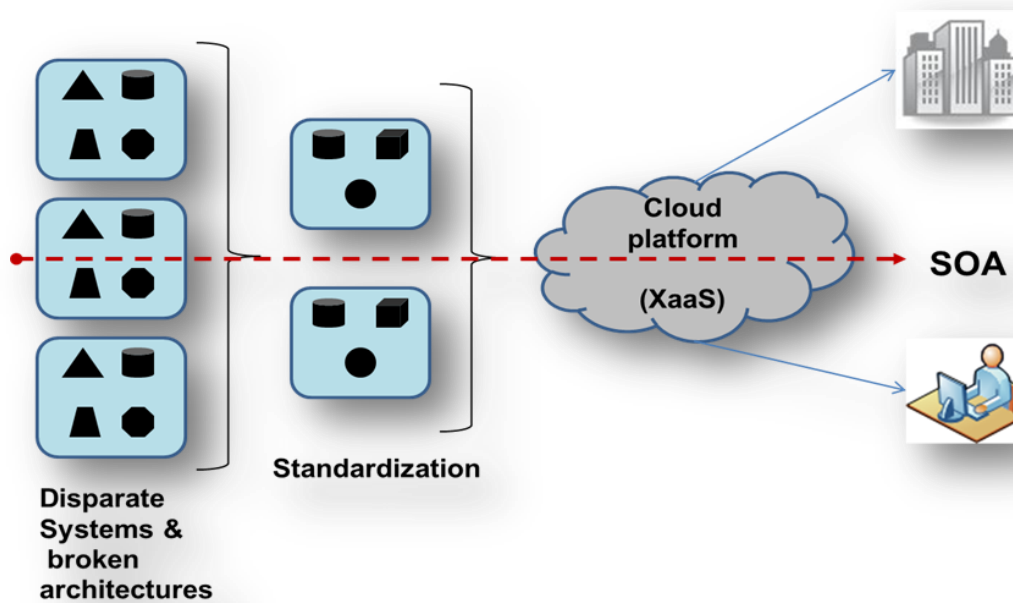


Figure 2: SOA principles traverses through an enterprise and cloud alike

## Synergies and divergence

SOA provides a good architecture reference pattern for cloud setup and operation; however, there are some divergent factors, though not severe enough, that need further research and focus. Overall, it will be a good practice to consider implementing SOA in cloud, since it provides a complementing approach to each other.

Standardization, abstraction, and re-use are the key functional items focused by both SOA and cloud. A good and sound architecture will render the IT footprint fool-proof and will help scaling the business requirements. SOA also helps categorize entities that should be within the enterprise firewall and that should be in the cloud. Service Design is one such key aspect that embodies SOA. This premise is responsible for the success of cloud computing through implementation of managed services design and on-demand delivery. SOA lays focus on this concept for any architecture to be successful in today's scenario. Typically a service-based approach (metering, billing, and so on) might not have been implemented within the organizational network, but becomes mandatory in a shared environment. Successful cloud providers such as Amazon, and Google, have excelled in this area. A modular services design has scalability and agility at its foundation, without which a cloud service would be difficult to provision. A case in point is the results of a cloud without Virtualization or automated provisioning of storage space for a VM.

Abstraction is best implemented in a cloud, when compared to other architecture implementations. Multi-tenanted and shared space reduces cost for an enterprise and also provides a flexible option to host Infrastructure and applications. This is one of the most-effective results of a SOA. In the perspective of a cloud provider, implementations are abstracted to a possible extent so that finer details are transparent to end-users (in this case, could be an enterprise) and they are provided with what they want, either in terms of server instances, storage space or even application build instances. Proper metering of usage, by using available tools is a USP to cloud (which is not done normally within an enterprise).

## Issues with co-existence

Evidently, SOA and cloud can co-exist though there are also certain issues that are not directly attributed to SOA, which the enterprise and cloud provider have to be cognizant about. One of the key issues for co-existence of SOA and cloud is the co-existence of different standards. For instance, an enterprise may have defined a particular standard for their services which may be deviant to standards of the cloud provider. A standard might still permit co-existence but might lead to additional modifications in the services framework. For example, an organization might use SOAP for their web services while the cloud provider might use CORBA. Though technically, there is no limiting factor in running such services, this could complicate the development process and might lead to redevelopment or reengineering of some applications.

The other limiting factor that might constraint the choice of the cloud service provider platform is development language and platform used in the enterprise. While Google supports use of only Java and PHP, others like Amazon support a wide range of languages, and allow enterprises to run web services in a language of their choice. Google platform might necessitate redevelopment of some applications before implementation in the cloud. This is just a case in point but there could be many such instances.

## Conclusion

SOA and cloud are complementary to each other and they help each other to grow and, they can be pursued either independently or concurrently. An effective practice of both these concepts will help enterprises to be more efficient and agile. Additionally there are other areas where SOA and cloud can learn from each other. There are certain limitations that exist in each of them separately, which when overlapped might lead to rework and redesign. An enterprise should evaluate all aspects, by comprehensively considering the pros and cons, before moving to cloud.

*In conclusion, SOA has helped cloud become what it is today and will continue to play a significant role in future. Increasingly SOA is being connected well with cloud and there are ample applications of SOA principles in architecting the cloudscape.*

## About the Author

**Vijaykumar** is a Principal Technology Architect with Infosys Technologies. He has around 18 years of experience in the IT Infrastructure domain, both in consulting and implementation. His areas of expertise include Consulting, IT Strategy, IT Infrastructure Design, Technology Migration and Program Management. He has authored multiple articles and spoken on industry forums.



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