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Collaboration between SOA and Cloud Computing at a Glance

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Abstract: ***SOA (Service Oriented Architecture) is an architectural style which is about orchestration of services whereas cloud computing is an autonomic computing which delivers computing as a service rather than product. People may consider SOA and Cloud as competitors but they complement each other. Cloud computing embraces the notion of "everything as a service" and covers three categories of service: infrastructure, platform and software as a service. SOA's approach of managing and governing processes is well-defined and has a potential for being applied to everything as a service in cloud. Since SOA is a relatively mature field, than Cloud, there is a good scope for cloud computing to judiciously inherit from best practice in SOA governance.***

Keywords: ***agility, governance, scalability, services.***

I. INTRODUCTION

In recent times, cloud computing has raised a significant amount of curiosity and excitement. It is being acclaimed that the cloud can resolve a wide range of IT challenges in innovative and useful ways. But if we give it a second thought, that doesn't seem so simple and possible. On the other hand, SOA (Service Oriented Architecture) had been around for some years and has benefitted business management and e-commerce in a very efficient manner. This paper is an attempt to understand the basic notions of two and take a look on the synergy between the two.

National Institute of Standards and Technology (USA) defines Cloud computing as "the delivery of computing as a service rather than a product, whereby shared resources, software, and information are provided to computers and other devices as a utility over a network".[2] A user can access cloud computing using application programs and networked client devices, likedesktop,computers, laptops, tablets and smartphones. An everyday example could be access of personal documents from anywhere from one's e-mail account through an internet connectivity, like Google-docs.

Service Oriented Architecture or SOA, as it is generally called, is an architectural approach that relies on as its fundamental design principle. Service – orientation is a way of integrating business as a set of linked services. It is a concept which has its own governance guidelines and aids to management of any business if implied.

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II. CLOUD COMPUTING: WHY THIS HYPE?

In 2010, Steve Ballmer **(**CEO – Microsoft) said, "Our industry is going through quite a wave of innovation and it's being powered by a phenomenon which is referred to as the cloud. India will not only see a surge in cloud computing services but companies all over the world will look to India to support their transition to cloud computing." This statement is an indication to the up-rising trend in IT industry, where the term 'cloud' has become more fashionable than anything in women's fashion-world.

There has been a revolutionary hype, but if we take a close look, we see that Cloud computing is a kind of autonomic computing that is comparable to grid computing. Cloud computing depends upon sharing of computing resources instead of keeping local servers or personal devices to handle applications. The term autonomic here means that this kind of computing is capable of self-management. Since it is available as a service, the user doesn't require bothering about the location of servers and enjoys the computing services as a utility, like electricity for example. It is sold on demand basis, like billing it on consumption per unit, like per hour. The user on a cloud can access the business software and data are stored on servers at a remote location via a web browser or mobile application or a light-weight desktop. The notion "cloud" comes from the fact that this service is available through an internet connection to the user and the cloud symbol has been often used to represent the Internet in flowcharts and diagrams. This symbol represents the intangible, yet global nature of the Internet. [3]

III.SERVICE MODELS:

A cloud broadly has three segments in its structure: Application , Storage and Connectivity. With certain variation among these three, the Cloud computing providers offer their services according to three fundamental models:

- Infrastructure as a service (IaaS),
- platform as a service (PaaS),
- software as a service (SaaS) [4]

A. *Infrastructure as a Service (IaaS)*

This is the most basic cloud service model. Here, the cloud providers offer computers, either as physical or as virtual machines , and provide storage, firewalls, networks and load balancers. IaaS providers supply these resources on demand from their large pools installed in data centers. This can be done in local area networks or in wide area networks, where the Internet can be used for connectivity.

To deploy their applications, cloud users install operating system images (sometimes called Gold Image) on the machines as well as their application software. Here, the user is responsible for maintaining the operating systems and application software. The cloud provider generates the of bill IaaS services on a usage (utility) computing basis, that is, cost will correspond to the amount of services consumed and resources allocated.

B. *Platform as a Service (PaaS)*

In the PaaS model, cloud providers deliver a computing platform that includes operating system, programming language execution environment, database, and web server. Application developers can develop and run their software solutions on a cloud platform without the cost and complexity of buying and managing the underlying hardware and software layers.

C. *Software as a Service (SaaS)*

In this model, users access the software from cloud clients and cloud provider has to install and operate application software in the cloud. The cloud users are not responsible for managing the cloud infrastructure and platform on which the application is running. This eradicates the need to install and run the application on the cloud user's own computers. Hence the maintenance and support becomes much simpler. The pricing format for SaaS applications is like a monthly or yearly subscription fee per user.[5]

Generalizing the concept of 'Cloud as a service', it would be relevant to quote Reuven Cohen here who said, "I think drawing a distinction on whether its, PaaS, SaaS, HaaS is completely secondary, ultimately all these approaches are attempting to solve the same problems (scale). As software transitions from a traditional desktop deployment model to that of a network & data centric one, "the cloud" will be the key way in which you develop, deploy and manage applications in this new computing paradigm."

Further, depending upon the deployment model, a cloud can be private or public. A *public cloud* sells services to anyone on the Internet. (For example, Amazon Web Services is the largest public cloud provider.) A *private cloud* is a proprietary network or a data centre that supplies hosted services to a limited number of people. When a service provider uses public cloud resources to create their private cloud, the result is called *a virtual private cloud*. Irrespective of the deployment model, whether it is private or public, the objective of cloud computing is to provide easy, scalable access to computing resources and IT services. [6]

A PEEK INTO THE WORLD OF SOA

SOA is an architectural approach for defining, linking, and integrating reusable business services that have clear boundaries and are self-contained with their own functionalities. Within this type of architecture, we can orchestrate the business services in business processes. [7]

SOA as architecture relies on *service-orientation* as its fundamental design principle. Service – orientation is a way of integrating business as a set of linked services. The service oriented architecture lets us orchestrate the business services in business processes. The largest single driver identified for adapting a SOA is 'agility'. Agility implies that SOA creates a flexible architecture, which enables for 'reconfiguring' over time. This attribute becomes significant when the target is a larger system that may change. This style of computing is not targeted toward being a better 'application architecture', but is more of 'IT system architecture'. [8]

IV. HOW SOA AND CLOUD COMPLIMENT EACH OTHER?

Though SOA had been here since long and cloud computing is at the leading edge of its hype-curve, yet there are certain characteristics due to which the two can strike a chord. The features which are common among the two and help them gel are:-

1. The most viable feature for adapting SOA in packaging and managing any business environment is its '*agility'*. It enables flexibility of IT systems that support the business architecture. [9] On the other hand, what makes a cloud application different from other applications is its '*elasticity*'. This can be achieved in a cloud by cloning tasks onto multiple virtual machines at run-time to meet the changing work demand. To accommodate a large number of cloud users, cloud applications can be *multitenant (*any machine serves more than one cloud user organization).
2. SOA being a "service - oriented" architecture packages all the business process as a service. This notion makes it easily adaptable, interoperable and suitable for heterogeneous systems. The generic cloud model sees everything "as a service" popularly called XaaS or *Eaas*, i.e., over the cloud of internet, everything is available as a service, from business process to powerful computing to socializing.
3. PaaS is just SOA for platforms without the baggage. Infrastructure services that can be provisioned and managed on-demand, can also apply policies on-demand. PaaS is also similar to that, it is like SOA reloaded. It's about leveraging *services* instead of libraries or adapters or connectors. It's about platforms – data, application, messaging – as a *service*. [10]

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V. COMMON CHALLENGES:

Having said that cloud models is one kind of service oriented architecture; we observe that in certain arena, SOA and Cloud face quite similar challenges. Also these challenges can be met by incorporating the best of both worlds in a judicial manner.

Joe McKendrick, analyst at McKendrick & Associates, says many of the challenges with cloud governance are exactly the same as those that companies have been wrestling with for service oriented architecture (SOA) for many years; namely, who controls the viability, reliability and security of the services being delivered? "An enterprise seeking to leverage services from a cloud environment needs to understand, first, what qualities and characteristics and dependencies are associated with the service; and second, how that service can be best orchestrated into their existing environment," says McKendrick. [1]

On the same notes as McKendrick, Michael Dortch, principal analyst and managing editor at DortchOnIT.com, says "Cloud governance isn't going to work if it's just cloud governance. Good governance of business resources, including but not just limited to IT resources, is good governance, whatever's being governed and wherever it happens to be."

One of the aspects of cloud that often flees from critical evaluation is governance – the question of how all the loose associations upon which cloud depends are to be maintained and operated in a way that is reliable and trustworthy. [1]

Thus, Dortch emphasizes, effective cloud governance must be part of policies and practices sufficiently flexible to embrace both existing and new resources equally in such a way that it is in compliance with and comprehensive to satisfy key business goals. This *good governance* may ideally be borrowed from SOA _Governance which has well defined norms for what is to be done rightly.

Dortch says governance needs to start with the decision makers who are building service-oriented architectures. They need to incorporate effective, business-driven management and governance tools and practices into those SOAs from the ground up for maximum business value and minimal disruption of business or IT operations. "Those decision makers must extend the most successful of these efforts into the cloud along with their IT architectures," he adds.

One solution to learn from what's been done in SOA over the past five to six years, is to see what are the best governance best practices, says McKendrick. Many enterprises deliver cloud-based services, either internally to business units or to external customers or partners. The design-time governance practices and tools seen in the SOA space can be very readily adopted to meet these requirements. But when it comes to the success in cloud deployments becomes uncertain when it's about one critical element: trust. Whether the focus is external, from the public cloud, or within a private cloud inside the enterprise, trust is significant. "Without trust that the service will perform as promised, in a secure, reliable way, there can be no effective business value to a service. That's a lesson learned the hard way in SOA work over the past decade, and it's a lesson that needs to be revisited in the cloud era," he says.

We may tend to think that cloud computing providers, including IaaS, PaaS and SaaS providers, would be all over the concept of SOA. It seems quite obvious. SOA has the ability to abstract cloud services into processes and turn those processes into business solutions. But, as a matter of fact, most cloud providers have no idea about what value SOA can add to their core business. Instead of capturing that value, they continue towards the cloud by selling infrastructure rather than solutions.

There are certain characteristics where SOA and Cloud complement each other, despite belonging to different streams. But there are also a few common challenges, which can be addressed by keeping the two in mutual collaboration. Here is an exploration into the synergy between SOA and cloud may benefit an enterprise who implements them.

Firstly, the concept of cloud should be into an architectural context, i.e., imbibe key SOA concepts, like service discovery, service provisioning, service management, and service governance. For instance, there should be an ability to find a database service, provide that service, monitor and manage that service, and then put and pull data into and from that service. This may be achieved by first developing some use cases around how to leverage that service in specific applications and architectures, including SOA. Second, there could be a link to service design and deployment tools, such as those for Oracle and IBM. The idea there is to make use of cloud-delivered services that can be part of the service directories, and become piece parts for building processes and composites. In other words, it's the ability for clouds to provide the raw materials used to build solutions, mixing and matching the services with those created locally. Last, but not the least, it could be taught to providers' user bases about the advantages of leveraging SOA as an approach to leveraging the cloud. If the people are trained with appropriate SOA guidance, and cloud computing is tactically allowed within an enterprise, it may turn the ordinary deals larger, favorable deals.

Both the concept of cloud computing and SOA will find each other as enterprises attempt to effectively leverage cloud computing. The best path to that destination is SOA.

True cloud computing architectures are elastic, expanding when you need more capacity. They allow you to add instances of your service as needed on the cloud. Such elasticity requires us to design differently. Same is the feature of SOA: agility. As Forrester Vice President and Principal Analyst John Rymer said at Boston's Application Development & Delivery Forum, "most of us have never thought this way. "In fact, as Rymer also notes that, "most of the existing applications that we built today don't scale to the cloud."[11].

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In June of 2011, David Linthicum presented a session entitled, "Handling data integration challenges in the cloud," and participated in the expert panel discussion, "What can go wrong in the cloud?" at the SearchSOA virtual event "SOA in Action, Navigating SOA, Integration and the Cloud." The main question from the panel discussion was – as the title suggests – about problems that enterprise organizations run into as they implement new cloud technologies as a part of their IT architecture. In this session, SOA expert David Linthicum says, "Service-orientation came about as a way to maximize the use and reuse of system resources". SOA aligns particularly well with Web applications and, according to Linthicum, the coming wave of cloud technologies is an extension of the core concepts behind SOA.

Linthicum also points that the biggest issue with cloud computing really is around architectural planning. When people who do not plan how clouds are implemented within their enterprise - public, private or hybrid, it matters not - are really going to be running into huge issues. So, you can't move into cloud computing without dealing with architecture. And typically I have to approach architecture with more of a service-oriented approach. Some enterprises do not give adequate forethought over how they're going to leverage cloud, how they're going to move to this environment, and pick the right systems that need to be moved, and then find the right migration and transformation path into the cloud. Then they end up making mistakes and they have to back up and fix things, and that gets costly. Ultimately, SOA environment emerges to the rescue.

VII.CONCLUSION

The values to be considered in this collaboration are two aspects: trust and agility. It gives an ability to change the enterprise' business processes to accommodate the needs of the enterprise, in almost real-time. That ultimately is the greater value of the cloud.

Finding the true connections between SOA and the cloud is not only the key to the success of the cloud, but also further upholds the value of SOA. If cloud borrows the governance and management features from SOA and establishes the link between the core values, agility and service-orientation, it can go a long way. The problem is that SOA concepts are pretty complex and heady, and many who are responsible with defining and building cloud technology may not prefer them due to lack of understanding.

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