SOA and Cloud Computing

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Abstract— Cloud computing and SOA are different concepts, but they are related. SOA is a pattern of architecture whereas cloud computing is an instance of architecture, or an architectural option. SOA is more holistic and strategic, meaning it deals with the complete enterprise including the business drivers, whereas cloud computing is more tactical and is a way of solving a problem. They are linked, and it is difficult to do one without the other if you are looking to solve problems at the enterprise level. Service-oriented architecture, or SOA, is really about fixing existing architectures by addressing most of the major systems as services and abstracting those services into a single domain where they are formed into solutions. Simple in concept—and really nothing new—SOA is our best approach to fixing the broken architectures. With the wide use of standards such as Web Services, SOA is being promoted as the best way to bring architectural agility to your enterprise—that is, if you do SOA correctly. SOA is a valid approach to solve many of the architectural problems that enterprises face today. However, those who implement SOA typically look at SOA as something you buy, not something you do. Thus, many SOA projects are again about purchasing some technology that is sold as "SOA in-a-box," which turns out to be in-a-box but not SOA, and thus only adds to the problems. Big SOA encompasses the larger strategic objectives of SOA: simultaneously moving all the enterprise IT assets to something much more agile and easy to change. Small SOA is just an instance of a big SOA.

Keywords: Cloud computing, SOA, shared services.

I. INTRODUCTION

A. What is SOA?

A service-oriented architecture is a collection of services that communicate with each other. The services are self-contained and do not depend on the context or state of the other service.SOA is architecture that represents software functionality as discoverable services on the network. Services are loosely coupled and support multiple technologies in integration. Enterprise architects believe that SOA help businesses respond more quickly and cost-effectively to the changing market conditions they may face by promoting reuse and interconnection of existing IT assets rather than more time consuming and costly reinvention. SOA builds on computer engineering approaches of the past to offer an architectural approach for enterprise systems, oriented around the offering of services on a network of consumers. A focus of this service-oriented approach is on the definition of service interfaces and predictable service behaviors. A set of industry standards, collectively labeled "Web Service" standards in this paper, provide and implement the general SOA concept and have become the predominant set of practical tools used by enterprise engineers for current SOA projects. Some Web Service standards have become foundational and more widely adopted, while many are still seeking broad industry or Government acceptance. SOA, as implemented through the common Web Services standards, offers Federal senior leadership teams a path forward, given the diverse and complex IT portfolio that they have inherited, allowing for incremental and focused improvement of their IT support systems.

B. What is Cloud Computing?

While cloud computing is currently a term without a single consensus meaning in the marketplace, it describes a broad movement toward the use of wide area networks, such as the Internet, to enable interaction between IT service providers of many types and consumers. Service providers are expanding their available offerings to include the entire traditional IT stack, from hardware and platforms to application components, soft ware services, and whole applications, as shown in . The common thread in cloud computing offerings across all levels of the stack is the consumer/provider relationship and a dependence on the network to connect the two parties. The commercial cloud marketplace offers a wide range of cloud services that vary in complexity and value. Figure organizes this marketplace into a general set of service categories layered in a notional stack, with foundational off erings toward the bottom and more complex offerings toward the top.

However, all cloud computing approaches are not the same, and several deployment models, while different, are still considered clouds computing: Private cloud. The cloud infrastructure is owned or leased by a single organization and is operated solely for that organization. Community cloud. The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations). Public cloud. The cloud infrastructure is owned by an organization selling cloud services to the general public or to a large industry group.

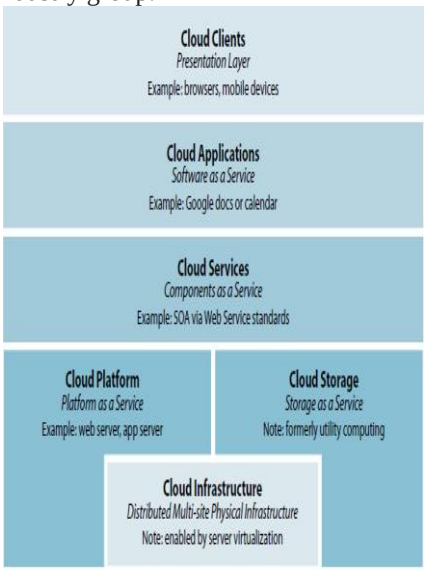

Fig. 1: Cloud Computing

Hybrid cloud the cloud infrastructure is a composition of two or more clouds (internal, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting). Each deployment model instance has one of two types: internal or external. Internal clouds reside within an organization's network security perimeter, and external clouds reside outside the same perimeter. For the purposes of this book, we focus primarily on public cloud computing, or the use of a public cloud provider or providers to host portions of our SOA. Many businesses will find that private clouds are a better solution for their situation, leveraging the benefits of cloud computing but within their firewall. Or, they may choose to leverage a mixture of public and private clouds, or a hybrid cloud. Finally, some may create semiprivate or community clouds, which are public clouds leveraged only by a closed group of companies or government agencies. While many in the industry can debate the components, there are 11 major categories or patterns of cloud computing technology: Storage-as-a-service ,Database-as-a-service ,Information-as-a-service ,Process-as-a-service ,Application-as-a-service ,Platform-as-a-service ,Integration-as-a-service ,Security-as-a-service ,Management/governance-as-a-service ,Testing-as-a-service , Infrastructure-as-a-service.

II. Overview

A. Comparing Cloud Computing and SOA

Cloud computing and SOA have important overlapping concerns and common considerations. The most important overlap occurs near the top of the cloud computing stack, in the area of Cloud Services, which are network accessible application components and soft ware services, such as contemporary Web Services.

Both cloud computing and SOA share concepts of service orientation.16 Services of many types are available on a common network for use by consumers. Cloud computing focuses on turning aspects of the IT computing stack into commodities 17 that can be purchased incrementally from the cloud based providers and can be considered a type of outsourcing in many cases. For example, large-scale online storage can be procured and automatically allocated in terabyte units from the cloud. Similarly, a platform to operate web-based applications can be rented from redundant data centers in the cloud. However, cloud computing is currently a broader term than SOA and covers the entire stack from hardware through the presentation layer soft ware systems. SOA, though not restricted conceptually to software, is often implemented in practice as components or soft ware services, as exemplified by the Web Service standards used in many implementations. These components can be tied together and executed on many platforms across the network to provide a business function. Loose coupling is identical characteristics in both SOA & Cloud, where any change in one part of the system should not produce more impact on the others and in turn on the overall systems.

B. Can SOA Be Skipped for Cloud Computing

SOA and cloud computing are complementary activities and both will play important roles in IT planning for senior leadership teams for years to come. Cloud computing and SOA can be pursued independently, or concurrently, where cloud computing platform and storage service offerings can provide a value-added underpinning for SOA efforts. Requirements unique to Federal organizations will determine the depth to which they can employ wholly commercial solutions, commercial-off - the-shelf products used to implement SOA service portfolios or cloud service providers on the public Internet. Regardless, the network-based concepts inherent in each will shape thinking about the architecture and economies of scale of large enterprise IT solutions, even when the Government finds it needs to create its own versions for policy, privacy, topology, or security reasons. Enterprise application integration continues—Cloud computing does not replace SOA, or the use of distributed soft ware components, as an integration technology. The need to support broader and more consistent integration of systems will continue. The trend by leadership teams to consider IT capabilities as a commodity will continue to put downward pressure on IT budgets and, consequently, integration and data exchange will have to get more streamlined and efficient, across a portfolio of disparate systems. SOA inspired componentization efforts, where soft ware leverages other network based soft ware, are a response to this pressure. Cloud computing and SOA are not synonymous, though they share many characteristics. Solving one does not complete the other. For example, consistently integrating your soft ware systems as distributed components or services (SOA) will not inherently virtualizes your hardware, or outsource your presentation layer to a third party provider (cloud computing). Accomplishing successful outsourcing of commodity IT functions (cloud computing) does not integrate systems custom to your business, or aggregate data into a single display "mash-up" (SOA). While SOA and cloud computing share many of the same concerns, considering all the layers of the IT support stack will require coordinating multiple dependent efforts. In summary, both cloud computing and SOA can support good engineering practices by enabling fundamental concepts such as abstraction, loose coupling, and encapsulation. Both approaches rely on the definition of clear and unambiguous interfaces, predictable performance and behavior, interface standards selection, and clear separations of functionality. Finally, cloud computing and SOA can be pursued independently, or concurrently as complementary activities.

C. SOA Meets Cloud Computing

The relationship between cloud computing and SOA is that cloud computing

Provides IT resources you can leverage on demand, including resources that host data, services, and processes. Thus, you have the ability to extend your SOA outside of the enterprise firewall to cloud computing providers, seeking the benefits already described. We describe this process as "SOA using cloud computing," and it is the objective of this book to show you how it is done. SOA is important to cloud computing for a few key reasons:

- It is a good approach to architecture that deals with the proper formation of the information systems using mechanisms that make them work and play well together, inside and outside of the enterprise.

- In order to take advantage of cloud computing, you need interfaces and architectures that can reach out and touch cloud computing resources. While many believe they can simply create quick and dirty links between core enterprise information systems and cloud computing resources, the fact is that you really need an architecture inside of the enterprise, such as SOA, to make the most of cloud computing.
- You need some sort of architectural discipline with guiding principles to document and organize your architecture. Most have ignored this need over the past several years to focus on ad hoc hype-drive stuff. We must get back to leveraging the best solution for the problem, and SOA is a good approach for doing that if you follow the steps.

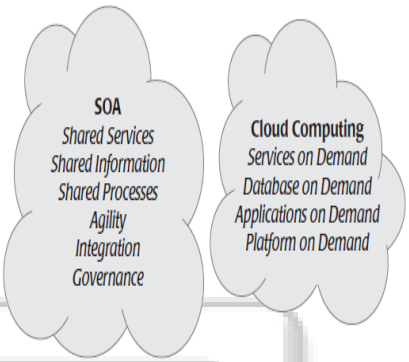

Fig. 2: Where Cloud Meets SOA

D. What SOA Can Learn from Cloud Computing

1) Service Design

Those who deploy services in the cloud, such as Amazon, Force.com, and others, have done a pretty good job with service design. You really *must* do a good job to rent the darn things out. Many SOA projects have a tendency to build in services that are too course-grained, too fine-grained, or just not at all well designed. We discuss this issue in more detail later in the book when we talk about service design and modeling for our SOA using cloud computing. In reality, unless services are not well defined and well designed, they will not sell well when delivered on demand. Those who provide services out of the cloud—which are most major cloud computing providers—therefore must spend a lot of time on the design of the services, including usability and durability. We urge those who build services within their SOA, no matter the enabling technology and standards involved, to look at the existing services available for rent as good examples of how services should be designed, developed, and deployed.

2) Service Expandability

Cloud computing services are designed to expand as needed, and those who leverage cloud services do so because they can get the services on demand, when they need them. The ability to expand services within an SOA is typically a painful and expensive process. The fact is that services designed and developed within enterprises typically are not designed to scale. Indeed, the core issues with SOA revolve around the fact that many within IT do not focus on scaling until it is too late and too difficult to fix. Cloud computing providers had to figure out scaling rather quickly.

E. What Cloud Computing Can Learn from SOA

1) Service Governance

There is little notion of governance today within cloud computing, and thus there is little control and implementation of policies. Therefore, many enterprises are not diving right into cloud computing. Governance, while not always well implemented, is a fundamental fact of life with SOA. The ability to set policies around services and to manage changes to those services is a critical success factor. As we weave cloud computing– delivered services into applications and within our SOA, we will find that many things break as the on-demand services change over time. Typically, SOA can manage the changes through SOA governance systems, but perhaps some of that governance should originate with the services that come out of the clouds.

2) Driving from the Architecture

Doing SOA properly means driving SOA from the architecture to the technology. Within the world of cloud computing, the resources on demand are the starting point. With cloud computing, the need for a well-thought-out architecture is just as important as for traditional systems, considering that you are extending the architecture out of the firewall. Using cloud computing resources is about extending your architecture out of the enterprise to incorporate cloud resources, and thus it is important to remember that your architecture does not end at the firewall. Understanding both the resources that exist within the enterprise and the resources that are cloud-delivered is even more critical, as is the need to configure these resources correctly in the context of architecture and to meet the needs of the business. Clearly, SOA and cloud computing go hand in hand. Cloud computing is just the ability to leverage new platforms and resources that you do not happen to own. Nothing really changes outside of that, including the need to do SOA right. However, cloud computing is accelerating the adoption of SOA by providing aspects of SOA on demand. SOA can learn a lot from the clouds, and the clouds can learn a lot from SOA.

F. Importance of Data with SOA Using Cloud Computing

We begin with the data because it is the foundation for most information systems and a good way to define what these systems do before we potentially relocate them to the clouds.; they map back to core architectural activities, including SOA. The purpose here is to understand the existing state of the data, define the data at a detailed level, and then define the final to-be data architecture that allows us to figure out which data should physically reside on-premise or on cloud computing platforms. However, this is all about doing SOA with the new architectural options of cloud computing. However, not much more than that changes. We still need to define how the data is structured, as well as relationships between the data, integrity, security, and all things in between. The big difference is that eventually we need to figure out how to manage data between on-premise and cloud-based systems, making sure that they function as if they exist within the same data center. That should be the objective. Many times when moving to new concepts such as cloud computing, architects and application designers have a tendency to neglect the fundamentals of the architecture, including the data. You do

this at the risk of architecture failure and the failure of any instances of cloud-based systems you build from that architecture. Those who do not grasp the underlying data will not be able to define the information systems that they will need, clouds or no clouds.

G. SOA, Agility, and Processes

Processes are core to the value of SOA; the ability to place things that will change over time into a configuration (or BPM) layer makes it easier to change key business processes. Cloud computing platforms are just places where those processes and services may reside—an architectural option. Thus, the core notion here is about placing things that may or will change over time into the process configuration layer and addressing things that will probably not change as services. For instance, the addition of a new product line may cause the way the company defines sales tax to change. Using processes, we can make that change as a configuration to a process and not force redevelopment of enterprise systems. This means that the architecture is better able to support change, which brings the value of agility to IT While SOA was initially sold around the value of reuse, or the ability to reuse services among various systems, users have come to discover that the real value that SOA provides is the ability to change core business processes without requiring waves of redevelopment, testing, and deployment. Agility has proven more valuable than reuse when considering the value of SOA. In a recent study published in *Information Week* entitled "InformationWeek Analytics: State of SOA," it was found that that the value of reuse is only marginal Thus, the value proposition around SOA is the ability to promote an agile architecture, or an architecture that is built to change. If we keep this objective in focus, the business value becomes apparent, considering the value of accommodating the needs of the business in a much timelier manner.

III. CONCLUSION

SOA is an architectural approach for all the business functions, which acts as the services and cloud is also services that adds to the architecture that we need not own it or host it. We will be having much more benefits when we approach Cloud using SOA foundation. It also withstand business agility.

REFERENCES

[1] Cloud computing and SOA (SERVICE-ORIENTED ARCHITECTURE) SERIES, Systems Engineering at MITRE, Geoffrey Raines.
[2] Cloud Computing and SOA Convergence in Your Enterprise, David S. Linthicum.
[3] Adapted from Sam Johnston, "Taxonomy: The 6LayerCloudComputing.Stack,http://samj.net/2008/09/taxonomy-6-layer-cloud-computing-stack.html and Frank E. Gillett, "Future View: The New Tech Ecosystem of Cloud, Cloud Services, and Cloud Computing, Vendor Strategy Professionals, Forrester Research
[4] Wikipedia, "Cloud computing" http://en.wikipedia.org/wiki/Cloud_computing
[5] Jeffery Poulin, "The ROI of SOA Relative to Traditional Component Reuse," Logic Library, 2006

