ISSN:0975-9646

Mangesh K. Nichat et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 5 (1) , 2014, 508-511

Review on Modeling and Implementation of Cloud Computing

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Abstract— **Cloud computing is an emerging technology. Advances in virtualization, storage, connectivity and processing power are combined to create a new ecosystem for cloud computing. In this paper the concepts of Cloud Computing like type of cloud, cloud deployment models, advantages of using cloud and risks involved in it are analysed. This paper tries to bring awareness among managers and computing professionals to use Cloud computing as an alternative to large in-house data centres.**

The current approaches to enabling real-time, dynamic infrastructure are inadequate, expensive and not scalable to support consumer mass-market requirements. Over time, the server-centric infrastructure management systems have evolved to become a complex tangle of layered systems designed to automate systems administration functions that are knowledge and labour intensive. This expensive and non-real time paradigm is ill suited for a world where customers are demanding communication, collaboration and commerce at the speed of light. Thanks to hardware assisted virtualization, and the resulting decoupling of infrastructure and application management, it is now possible to provide dynamic visibility and control of services management to meet the rapidly growing demand for cloud-based services.

Keywords**—Cloud Computing, IAAS, PAAS, SAAS, Storage Area Network(SAN),Hardware Assisted Virtualization(HAV).**

I. INTRODUCTION

The fundamental concept of cloud computing is that the computing is “in the cloud”. It refers to accessing software and storing data in the “cloud” representation of the Internet or a network and using associated services. Most cloud computing infrastructures consist of services delivered through common centers and built on servers. Clouds often appear as single points of access for consumer’s computing needs.

Cloud computing is the delivery of computing and storage capacity as a service to a community of end-recipients. The name comes from the use of a cloud-shaped symbol as an abstraction for the complex infrastructure it contains in system diagrams. Cloud computing entrusts services with a user's data, software and computation over a network.

Cloud computing pretends a major change in how to store information and run applications. Instead of running programs and data on an individual desktop computer, everything is hosted in the “cloud”—a nebulous assemblage of computers and servers accessed via the Internet. Cloud computing lets you access all your applications and documents from anywhere in the world, freeing you from the confines of the desktop and making it easier for group members in different locations to collaborate [5].

“Cloud computing is a model for enabling convenient, on demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction [1].”

II. CLOUD COMPUTING SERVICE TECHNOLOGIES

Cloud computing is about moving services, computation or data—for cost and business advantage— off-site to an internal or external, location-transparent, centralized facility or contractor. By making data available in the cloud, it can be more easily and ubiquitously accessed, often at much lower cost, increasing its value by enabling opportunities for enhanced collaboration, integration, and analysis on a shared common platform. Depending on the type of provided capability, there are four scenarios where Clouds are used as showed in figure 1.

1) Infrastructure as a Service

IPs manage a large set of computing resources, such as storing and processing capacity. Through virtualization, they are able to split, assign and dynamically resize these resources to build ad-hoc systems as demanded by customers, the service points. They deploy the software stacks that run their ser-vices. This is the Infrastructure as a Service (IaaS) scenario.

2) Platform as a Service

Cloud systems can offer an additional abstraction level instead of supplying a virtualized infrastructure, they can provide the software platform where systems run on. The sizing of the hardware resources demanded by the execution of the services is made in a transparent manner. This is denoted as Platform as a Service (PaaS). A well-known example is the Google Apps Engine.

3) Software as a Service

Finally, there are services of potential interest to a Wide variety of users hosted in Cloud systems. This is an alternative to locally run applications. An example of this is the online alternatives of typical office applications such as word processors. This scenario is called Software as a Ser-vice (SaaS)[8].

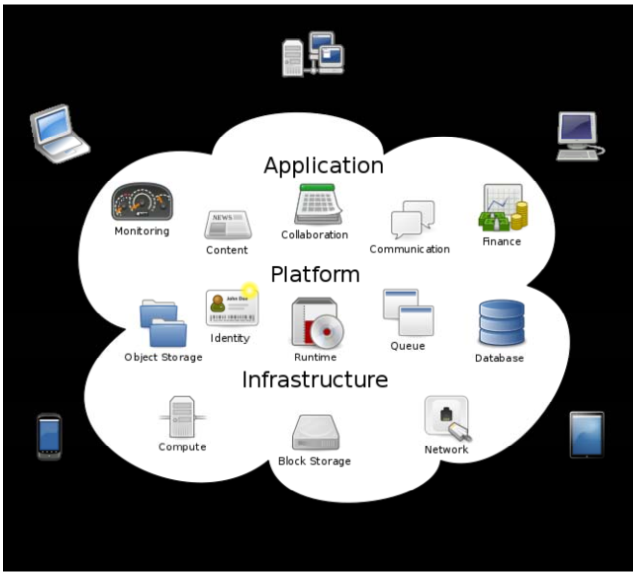

Figure 1:. Cloud Computing

III. DEPLOYMENT MODULES

Several different cloud deployment models should be considered when evaluating a cloud-computing architecture. Cloud models currently in the marketplace or emerging in the near future include: public clouds, private clouds, virtual private clouds, Community, Hybrid and Interclouds.

1. Public Clouds

Public clouds are "stand-alone" or proprietary, mostly off premise, run by third party companies such as Google, Amazon, and Microsoft. Public clouds are hosted off consumer premises and usually transparently mix applications from different customers on shared infrastructure.

2. Private Clouds

Private clouds are typically designed and managed by an IT department within an organization. A private cloud is usually built specifically to provide services internally to an organization. Private clouds may be in a co-allocated facility or in an existing data center. This model gives a high level of control over the cloud services and the cloud infrastructure.

3. Virtual Private Clouds

Virtual private clouds allow service providers to offer unique services to private cloud users. These services allow customers to consume infrastructure services as part of their private clouds. The ability to augment a private cloud, with on-demand and at-scale characteristics, is typical of a virtual private cloud infrastructure. Private cloud customers can smoothly extend the trust boundaries (security, control, service-level management, and compliance) to include virtual private clouds. The virtual private cloud concept introduces the complexities of migrating workloads and related data from a private cloud.

4. Intercloud

In the long term, the intercloud will emerge as a public, open, and decoupled cloud-computing inter-network, much like the Internet. In a sense, the intercloud would be an enhancement and extension of the Internet itself. Just as the Internet decouples clients from content (i.e., you do not have to have a preexisting agreement with a content provider to find and access its website in real time), the intercloud will decouple resource consumers (enterprises)from cloud resource providers, allowing the enterprises to find resources on demand and without preexisting agreements with providers. Workload migration will be the dominant use case for the intercloud as an open market establishes trust standards and public subsystems for naming, discovering, and addressing portability and data/workload exchange.

5. Community Cloud

The cloud infrastructure is shared by organizations that have a common interest. This model supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be managed by the organizations or a third party and may exist on-premise or off-premise.

IV. CURRENT CLOUD COMPUTING

In the cloud computing era, the computer can no longer be thought of in terms of the physical enclosure – i.e. the server or box, which houses the processor, memory, storage and associated components that constitute the computer. Instead the "computer" in the cloud ideally comprises a pool of physical compute resources – i.e. processors, memory, network bandwidth and storage, potentially distributed physically across server and geographical boundaries which can be organized on demand into a dynamic logical entity i.e. a "cloud computer", that can grow or shrink in real-time in order to assure the desired levels of latency sensitivity, performance, scalability, reliability and security to any application that runs in it. What is truly enabling this transformation today is virtualization technology – more specifically hardware assisted server virtualization.

At a fundamental level, virtualization technology enables the abstraction or decoupling of the application payload from the underlying physical resource. What this typically means is that the physical resource can then be carved up into logical or virtual resources as needed. This is known as provisioning. By introducing a suitable management infrastructure on top of this virtualization functionality, the provisioning of these logical resources could be made dynamic i.e. the logical resource could be made bigger or smaller in accordance with demand. This is known as dynamic provisioning. To enable a true "cloud" computer, every single computing element or resource should be capable of being dynamically provisioned and managed in real-time. Presently, there are many holes and areas for improvement in today's data center infrastructure before we can achieve the above vision of a cloud computer. Below we discuss these for each of the key data center infrastructure components [2].

A. Server Operating Systems and Virtualization

Whereas networks and storage resources - thanks to advances in network services management and SANs, have already been capable of being virtualized for a while, only now with the wider adoption of server virtualization do we have the complete basic foundation for cloud computing i.e. all computing resources can now be virtualized. Consequently, server virtualization is the spark that is now driving the transformation of the IT infrastructure from the traditional server-centric computing architecture to a network-centric, cloud computing architecture. With server virtualization, we now have the ability to create complete logical (virtual) servers that are independent of the underlying physical infrastructure or their physical location. We can specify the computing, network and storage resources for each logical server (virtual machine) and even move workloads from one virtual machine to another in real-time (live migration). All of this has helped to radically transform the cost structure and efficiency of the datacenter. Capacity utilization of servers can be increased and overall power consumption can be dramatically reduced by consolidating workloads. Additionally, thanks to server virtualization and live migration, High Availability (HA) and Disaster Recovery (DR) can be implemented much more efficiently.

B. Storage Networks & Virtualization

Before the proliferation of server virtualization, storage networking and storage virtualization enabled many improvements in the datacenter. The key driver was the introduction of the Fiber Channel (FC) protocol and Fiber Channel-based Storage Area Networks (SAN) which provided high speed storage connectivity and specialized storage solutions to enable such benefits as server-less backup, point to point replication, HA/DR and performance optimization outside of the servers that run applications. However, these benefits have come with increased management complexity and costs. In fact SAN administrator costs are often cited as the single most critical factor affecting the successful deployment and management of virtual server infrastructure.

C. Network Virtualization

The virtual networks now implemented inside the physical server to switch between all the virtual servers provide an alternative to the multiplexed, multi-pathed network channels by trunking them directly to WAN transport thereby simplifying the physical network infrastructure. With the proliferation of multi-core multi-CPU commodity servers, it has almost become necessary to eliminate the mess of cables otherwise needed to interface multiple HBAs and NICs for each application with a single high speed Ethernet connection and a virtual switch. It is our contention that resultant architectural simplicity will significantly reduce associated management burden and costs.

D. Application Creation and Packaging

The current method of using Virtual Machine images that include the application, OS and storage disk images is once again born of a server-centric computing paradigm and does not lend itself to enable distribution across shared resources. In a cloud computing paradigm, applications should ideally be constructed as a collection of services which can be composed, decomposed and distributed on the fly. Each of the services could be considered to be individual processes of a larger workflow that constitutes the application. In this way, individual services can be orchestrated and provisioned to optimize the overall performance and latency requirements for the application [2].

V. NEXT REFFERENCE MODEL OF CLOUD COMPUTING

As we highlighted in the previous section, we are yet to achieve perfect decoupling of physical resources management from virtual resource management but the introduction and increased adoption of hardware assisted virtualization (HAV) as an important and necessary step towards this goal. Thanks to HAV, a next generation hypervisor will be able to manage and truly ensure the same level of access to the underlying physical resources. Additionally, this hypervisor should be capable of managing both the resources located locally within a server as well as any resources in other servers that may be located elsewhere physically and connected by a network. Once the management of physical resources is decoupled from the virtual resource management the need for a mediation layer that arbitrates the allocation of resources between multiple applications and the shared distributed physical resources becomes apparent.

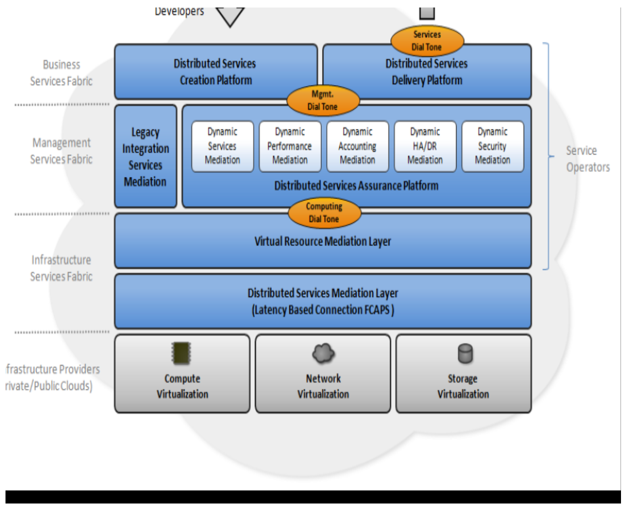

Fig Reference Architecture Model for Next Generation Cloud Computing Infrastructure

- *Infrastructure Service Fabric:* This layer comprises two pieces. Together the two components enable a computing resource "dial-tone" that provides the basis for provisioning resource equitably to all applications in the cloud:
  1. Distributed Services Mediation: This is a FCAPS based (Fault, Configuration, Accounting, Performance and Security) abstraction layer that

enables autonomous self-management of every individual resource in a network of resources that may be distributed geographically, and a

2. Virtual Resource Mediation Layer: This provides the ability to compose logical virtual servers with a level of service assurance that guarantees resources such as number of CPUs, memory, bandwidth, latency, IOPS (I/O operations per second), storage throughput and capacity.

- *Distributed Services Assurance Platform:* This layer will allow for creation of FCAPS-managed virtual servers that load and host the desired choice of OS to allow the loading and execution of applications. Since the virtual servers implement FCAPS-management, they can provide automated mediation services to natively ensure fault management and reliability (HA/DR), performance optimization, accounting and security. This defines the management dial-tone in our reference architecture model. We envision that service providers will offer these virtual servers with appropriate management API (management dial-tone) to the service developers to create self-configuring, self-healing, self optimizing services that can be composed to create self-managed business workflows that are independent of the physical infrastructure.
- *Distributed Services Delivery Platform:* This is essentially a workflow engine that executes the application which - as we described in the previous section, is ideally composed as business workflow that orchestrates a number of distributable workflow elements. This defines the services dial tone in our reference architecture model.
- *Distributed Services Creation Platform:* This layer provides the tools that developers will use to create applications defined as collection of services which can be composed, decomposed and distributed on the fly to virtual servers that are automatically created and managed by the distributed services assurance platform.
- *Legacy Integration Services Mediation:* This is a layer that provides integration and support for existing or legacy application in our reference architecture model.

Vi.CONCLUSION

In this paper, we have described the requirements for implementing a truly dynamic cloud computing infrastructure. Such an infrastructure comprises a pool of physical computing resources – i.e. processors, memory, network bandwidth and storage, potentially distributed physically across server and geographical boundaries which can be organized on demand into a dynamic logical entity i.e. “cloud computer”, that can grow or shrink in real-time in order to assure the desired levels of latency sensitivity, performance, scalability, reliability and security to any application that runs in it.

We identified some key areas of deficiency with current virtualization and management technologies. In particular we detailed the importance of separating physical resource management from virtual resource management and why current operating systems and hypervisors – which were born of the server-computing era, are not designed and hence ill-suited to provide this capability for the distributed shared resources typical of cloud deployment. We also highlighted the need for Fault, Configuration, Accounting, Performance and Security (FCAPS) based service “mediation” to provide global management functionality for all networked physical resources that comprise a cloud – irrespective of their distribution across many physical servers in different geographical locations. We then mentioned a reference architecture model for a distributed cloud computing mediation (management) platform which will form the basis for enabling next generation cloud computing infrastructure.

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