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An Initiative Study on Software Defined Cloud Computing

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Abstract

Cloud Computing is the use of hardware and software to deliver a service over a network (typically the Internet). With cloud computing, users can access files and use applications from any device that can access the Internet. An example of a Cloud Computing provider is Google's Gmail. Software-defined networking (SDN) is an architecture that aims to make networks agile and flexible. The goal of SDN is to improve network. Various applications have different requirements. Network conjestion within a data center can cause severe failure for an application. In SDN -enabled clouds it is possible for transferring high priority data over the other traffics in network conjestion by reconfiguring network flows dynamically. SDN and CC have been widely used in research and industrial fields, but widespread acceptance of Software Defined Cloud Computing is hampered due to security threats.This also states the importance of SDCC in two domains resource orchestration and application development. Software Defined Cloud Computing helps to attain a certain level of Quality of Service for an application. We refer to Software-Defined Cloud Computing, or simply Software-Defined Clouds (SDC), as an approach for automating the process of optimal cloud configuration by extending virtualization concept to all resources in a data center.

Introduction

Cloud computing is basically using of servers present on the internet to store,manage and process data rather than using the servers present on the users computer. As the application model around us is changing so are the networking applications. The adoption of Cloud Computing based services is becoming more inescapable since it has influence over various applications used by a lots of people around the world. Clouds are used to access the data stored in the cloud storage from any location at any desired time. Software Defined Network provides flexibility and dexterity to any network.A software defined infrastructure provides competitive advantage for a new generation of workloads. Software Defined Network decouples the two planes namely control plane and data plane. The concept of Software Based Cloud Computing (SDCC) points towards various networking functions such as Virtualization. The fundamental concept of SDCC is that the network traffic is centrally managed due to the centralized brain(controller) architecture of Software Defined Network. Software Defined Network (SDN) aims to centralize the control and is the emerging architecture of network which gives importance to various future necessary concepts like Network Functions Virtualization (NFV) and Edge computing which is preffered over cloud computing. All the resources like storage systems , virtual machines created and the data stored by the user utilizing the service is managed and maintained by the cloud controller. [10-18]

There are Cloud service models namely-

(1) Platform as a Service (PaaS),

(2) Infrastructure as a service (IaaS) and

(3) Software as a service (SaaS).

Each of which has its own characteristics.

SDN and Cloud Computing together are creating numerous oppourtunities in both research and industrial field where the focus stays on the security issues for the develpoment of the technologies using Software

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Defined Cloud Computing.

Overview (Literature Survey)

Server-client model also known to be the distributed model is one of the two models in computer architecture, while the other model is the one that is widely used now-a-days due to its suitability for Cloud Computing also known as the Centralized model. Centralization is basically combining the control plane of the system which tends to help maintianing the data at the place where access to the data is easy due to its central locality.[5]. Cloud computing provides features such as data processing of large amount of data and extended amount of storage period of the data.[7] Edge Computing is rising over Cloud computing as it has its own advantages over Cloud computing. Huge volumes of data and massive traffic flows may cause network congestion. Network conjestion occurs when one link is carrying data more than its capacity due to huge data requirements. Such problems leads to delay in transfer of data, packet loss or it may also end up blocking new connections. The data is processed on the edge (near the device or sensors) primarily, this is the way in which Edge computing can overcome the problem of network conjestion. Edge computing provides low latency, reduces bandwidth usage and thus reducing the total load on the link in the network and avoiding conjestion which leads to smooth and fast processing of data. The main reason which leads us to use the Edge computing over Cloud computing is that Edge computing optimizes performance and cost of the system by using Cloud computing features with added Edge computing features such as low latency data processing[19 20]. Edge computing technology is under development for numerous reasons, some of which are stated below-

(1) ultra low latency data trasnfer ,

(2) Development of IoT and

(3) Network Function Virtualization (NFV).

Software platform created for Network Function Virtualization (NFV) can also be used for Edge computing as they have some common features where they can deploy functions.Video analytics were deployed at the edge of the network using SDN and NFV extended architectures which resulted in reducing the bandwidth usage upto 90%.

Service quality falls due to network conjestion while using the Cloud computing and hence to improve the service quality, features of Cloud computing are added up to capabilities of Edge computing.

Intent Based Networking is based on Machine Learning, Artificial Intelligence and network orchestration .The way of managing, leveraging and allocating is known as orchestration. Orchestration offers agitity and reduces costs and also coordinates automated tasks. IBN and SDN are similar in many aspects. It is an emerging technology as Software Defined Cloud Computing (SDCC) is. IBN requires complex integration of SDN, NVF, Cloud, Machine Learning, Open source software.[1]. The amount of traffic generated varies as comparing to the different time periods of the day, despite of that QoS should always be maintained.Therefore the main goal points towards improving the QoS of SDN based clouds technologies.[8,3]

SDN is a technology which centralizes the control into the controller separating data controlling and data transferring functions.[7]

Network Virtualization (NV) provides the user with a virtual machines to work on, thus including various schemes of NV with the SDN leads to a new path which introduces us to feature of NV - address and topology virtualization. In this for creating Virtual machines the server is provided with a software called as Network Hypervisor (NH). Virtualization provides isolation between users that are utlizing the service by translating virtual IP and MAC address into corresponding IP and MAC address. This helps users to

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form a arbitrary address to virtual networks that they are using.[4,6]

Moblie Edge Computing (MEC) consists of NFV and SDN and Cloud computing. It is a time saving approach as it does not upload all the data to remote data cloud, instead it filters that data so that the data is analyzed and filtered in terms of the user. Thus reducing core network pressure and reducing data transmission from mobile devices to cloud. MEC transfers storage from core network to edge network which effectively reduces network delay.[2,4]

Applications of Cloud Computing are:

(1)Online Storage ,

(2) Photo and video editing software ,

(3) Presentation software (slide rocket) ,

(4) Finding way on maps ,

(5) Word processing app.

We don't have to manage and maintain the applications on the cloud. The vendors of the cloud take care of managing and maintaining the cloud. We only have to use the services that we pay for on the cloud.

Cloud Computing is about one uniform architecture that works for all applications such as Big Data, Storage, Virtualization ,etc.

Cloud Service Models:

IaaS-Infrastructure as a Sevice

IaaS provides an infrastructure to the cloud customer where the customer gets access to various features. The user can make use of the provided infrastructure as per their needs. Its work is to provide a basic model of infrastructure to the user and the further flexible use is to be made by the user. It also provides virtual machine and storage systems to store and process data while the user does not have to worry about the underlying physical machine or resources, they are taken care of by the cloud vendor. Infrastructure is provided to the client along with the IP address. This service is generally used by the system administrators.

SaaS-Software as a Service

Front end is placed in front of the user utilizing SaaS that is a software is provided. We just have to utilize the services of the software provided. The user does not need to care about the back end such as the storage of data, security, how many servers are used, how many physical machines are used, how the virtual storage is implemented, the operating system used, etc. The user does not need to install the software on any particular PC thus releasing the user from maintaining the software. The vendor takes care of maintainance. It is a platform independent service, that is the user may have any OS like mac, windows, etc while the only thing required is the high speed internet for accessing this service. This service is used by the end users like the general public.

PaaS-Platform as a Service

PaaS does not give access to middle ware, Operating system, Virtual machine, Virtual storage and data storage. PaaS only provides access to the user interface which is a run time environment which is utilized for developing and deploying application purpose. The deployment tools are also provided by the Cloud

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vendor. Thus PaaS provides all the tools required the user does not need to purchase expensive hardware and software. This service is generally used by the Developers given that the developer has basic knowledge of tools provided by this service and high speed internet. [9]

Networking history starts form the early 70s where the system of networks were defined as the remote terminal topology or the mainframe. These are not switches while the networks we have today look a lot like switches. These are actually servers, where the hosts are connected to the mainframe and the only communication that can take place is between the host and the mainframe, thus making it the most fundamental infantile network. The mainframe being the central computing cross makes the system non scalable. In 80s we came up with something called as micro computing or point-to-point network and it looked a lot like a circular topology. All the computers connected in the circle are hosts. If we have to communicate between two hosts not directly connected to each other we had to hop between several hosts thus making the network non scalable, it also was unstable and very expensive. In 90s networking developed and came up with Local Area Network (LAN) that provides us with various topologies such as star and mesh. Nothing has changed since 1990 when it comes to networking. We have been using the same topology using bridges now known as switches and the only evolution that has taken place is we have released more protocols and come up with faster connections.

The virtual look of the switch includes two planes -[1]Control plane and the [2]Forwarding plane. Forwarding plane is a hardware and it exists on the Application Specific Integrated Circuit (ASCI). The basic task of the forwarding plane is to push the packets. It is like a small CPU sitting inside the server. The control plane is where all the protocols sit. The communication between the two routers is done with the help of control plane. Routing table that sits inside the control plane is the Router Information Base. Once the control plane identifies the direction and speed that it wants to take the software communicates with another routing table that sits below it in the Forwarding base called the Forwarding Information base. This is very expensive as there is a lot of hardware and software in the same machine. If there are three such machines connected we have three RIBs, three FIBs with three command line interfaces, three security suits and three operating systems. In open SDN the control plane is separated from the forwarding plane and is placed at a central location which hosts all the security, programmability, the command line interfaces and various other features. All the forwarding planes connected to the central control plane does the work of forwarding the packets. Thus this is how we have commoditized switching to a inexpensive and scalable level. Open flow protocol is used to separate these two entities (Control and Forwarding plane). This is what a Software Defined Networking capable switch looks like.

Conclusion:

Software Defined Cloud Computing addresses various problems such as unavailability of resources and cost of the resources. SDCC manages to solve the problem by providing open environment to the users managing the data. Users can access the resources according to their needs. It reduces management cost and security costs as the vendor providing the service looks after it. The cloud containing the particular resource which is used by a user is maintained by the cloud vendor. The user can use any Cloud service model according to their needs. Sofware Defined Network centralises the control of the system and can be used along with Network Virtualization, where it provides isolation to the user by providing user with a virtual IP address.

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