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In the Direction Regarding Implementation for Cloud OS: A Review

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ABSTRACT

With the exponential improvement of the recent information technologies, the use of cloud-based services, Internet of Things (IoT), and Big Data in the manufacturing industries of key national sectors such as shipping, energy, material science, refining, chemicals, banking, defense, etc., is unavoidable. Recently, cloud computing has been a hot subject. As large businesses such as Google and Microsoft have introduced launching cloud-based apps, advertising with cloud usage, and even releasing an open-source-based Cloud OS, cloud computing has lately seen a substantial rise in popularity. As the public becomes more conscious of cloud-based computing, the need for protection will rise as popularity grows. Extensive focus has been drawn to several research questions in cloud computing for the operating system in the cloud. Throughout this study, we discussed the cloud-based operating system (OS) architecture in cloud computing, issues related to the Cloud OS, and critical challenges while implementing and designing Cloud OS. Furthermore, a comprehensive review is presented by the author in the overall article.

Key words: Cloud Computing, Operating System, IaaS, PaaS.

1. INTRODUCTION

Cloud computing, which was released recently, is evolving as a hot topic. It can deliver scalable complex IT infrastructures, QoS assured virtualized resources, and fully customizable online platforms. Cloud computing emerged as a significant paradigm for computing that intends to facilitate credibly, customizable, and QoS assured dynamic operating systems and end-user applications [1]. The word "cloud" derives first from the telecommunications world, where vendors started with the help of a virtual private network (VPN) systems for the communication of information [2]. Overall Cloud infrastructure deals with computing, applications, internet connectivity, and storage facilities that do not need end-user information of the device's geographic position and setup that delivers the cloud services. Cloud computing is a new technology that shifts computing resources with information far away from the laptop and compact PCs to giant centers of data [3].

The operating system (OS) is a hardware-based software interface. The OS is a program serving as a bridge between software and the machine's hardware. For multiple users, the operating system manages and coordinates the hardware's use by the different application programs. The Operating System describes an allocator of resources that handles and allocates resources. The Operating System describes the control program as regulating the execution and application of I/O devices by user programs. The operating system describes the kernel as the only program always running. OS features needed for the system-provided multiprogramming I/O routine. The system's memory control must delegate memory to multiple jobs. The machine must select from many ready-to-run jobs for CPU scheduling [4].

A Cloud-Based OS is a form of operating system built to control inside cloud services and virtualization frameworks. A Cloud-based OS handles the service and execution of processes of virtual computers, servers, VM infrastructure, and tools of backend software and hardware. In a virtualized environment, a Cloud-Based OS mainly handles one or more Virtual Machines (VM). The functionality of Cloud-Based OS differs, and it depends on the virtual environment and cloud applications in operation.

A Cloud-Based OS is in control of coordinating infrastructure, much as a computer Operating System (OS). In a computer, for example, Personal Computer (PC), the Cloud-Based OS is in control of coordinating numerous hardware resources, such as CPUs, storage, drives, networking devices – all within a server framework. It protects the specifics of the hardware process and enables these precious resources to be exchanged effectively. Cloud OS has the same function. Instead of handling the help of a single system, Cloud-Based OS has responsibility of managing the cloud overall infrastructure, protecting the specifics of it from the application related programmers, and organizing the sharing of scarce resources services [5].

This study has provided a comprehensive review that defines the architecture of Cloud computing, Implementation, and design of Cloud-based operating systems. The Key Challenges and security issues related to Cloud-Based Operating System.

Furthermore, section II describes Cloud Computing and its Architecture. Section III discussed Cloud OS. Section V posed the challenges related to Cloud OS. Finally, the conclusion has been discussed.

2. CLOUD COMPUTING ARCHITECTURE

In cloud computing, internet tools and programs retrieve resources from the internet. It encourages people to operate remotely, and it is easy to use the cloud as an "Internet." It is also not treated as ordinary outsourcing. It is also called Huge Computation. The application allocation must be problematic in this situation. All sorts of hardware and applications do not need to be installed. The main purpose of Cloud computing is to authorize users to access data related to technology and applications without any profound awareness of them [6]. In the architecture of cloud computing, high-power computers are not needed to operate internet services. The apps, data, and services are all hosted in the server via the network in the cloud computing environment, and the apps and stored data are run by providing digital tools as on-demand services. We are now defining various cloud computing modes as follows:

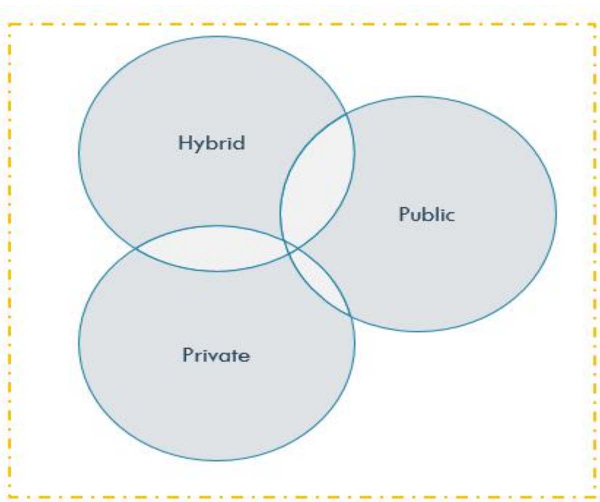

Figure 1: Various modes of Cloud Computing.

2.1 Private Cloud

A particular company is devoted to these cloud services, and the cloud cannot share with other organizations. Private cloud is more secure and required more cost as compared to the other clouds especially public cloud.

2.2 Public Cloud

Various organizations will share it. For instance, —Amazon, Google. Storage of general computing applications is made open to all organizations. It is often referred to as the' External Cloud.' Via online services, resources are dynamically spread over the internet.

2.3 Hybrid Cloud

It consists of Public and Private Cloud combinations and more than two modes of clouding. Organizations can host essential public cloud or private cloud applications that focus entirely on specifications. Service technology is stored in private clouds in a hybrid cloud, half of the applications, while the rest is partially processed in public clouds [7][8]. And the following modes of cloud services can be seen in Figure 1.

Cloud storage involves a virtual cloud that manages user knowledge and applications. The consumer does not have to rely on the infrastructure of the device. Total grid infrastructure and service computing kit are referred to as a cloud computing weasel word. The summary of the critical services related to cloud architecture is mentioned in the preceding chapter [9] and shown in Figure 2 as well:

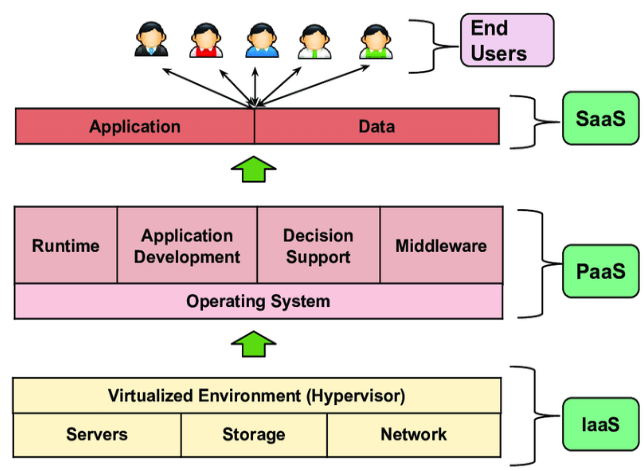

Figure 2: Cloud Computing Services Paradigm

2.4 Platform-as-a-Service (PaaS)

PaaS is a deployment service provider that is delivered to users over the network. No device installation or hardware specifications are expected by the customer, thus reducing money. It is a middleware from which apps are constructed. For the applications deployed, PaaS is consisting of such tools that are already built-in and are related to the security, and interfaces of web services. It is possible to incorporate the deployed program into the same platform with other related applications and integrated with another applications interface. PaaS has applications that consist of a database, middleware, and tools for development [10][11].

PaaS's core functionality is to provide databases, development and testing, integration, business intelligence, and application deployment [12].

2.5 Infrastructure-as-a-Service (IaaS)

Infrastructure as a Service shared services as an operation, of servers, network, memory, and OS Based. It offers a Virtual Machine configure and built-in OS. IaaS provides for the storage of data in multiple geographical locations. In the cloud data centers, IaaS vendors monitor operations while giving consumers the freedom to install and handle computing services themselves. The customer is authorized to computers, servers, network infrastructure, device implementation, and working computing resources [13].

The Core functionality of IaaS is to provide Back and recovery. Another service is to give the availability of storage. The most important feature is to provide Content Delivery Networks (CDNs).

2.6 Software-as-a-Service (SaaS)

In this service type, a hosted set of software runs on the platform, and infrastructure is deployed, these all services offered from the cloud services provider to the customer. Applications are planned and built to be concurrently consumed by multiple cloud users over the Internet. CSP host the application, which sustains the system and assures recent operation. The host application checks for multitenancy is available on request and can be downscaled. Any SaaS providers operate on PaaS or IaaS offerings from other cloud providers.

The Cloud Computing paradigm is also alluded to as the Layered Computing Model [1]. The cloud computing segment is further segmented into a total of four layers: hardware, infrastructure, platform, and application, as seen in Figure 3:

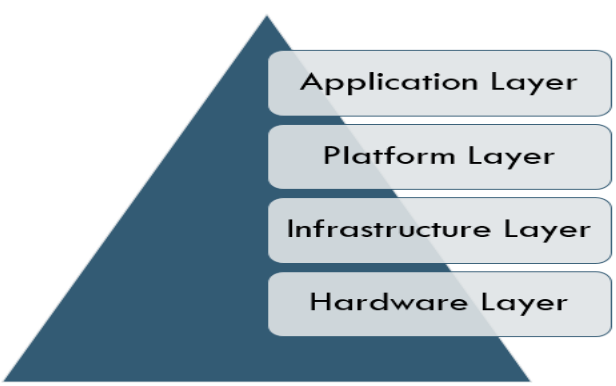

Figure3: Layered wise Architectur0065 of Cloud Computing

The Core functionality of SaaS is to provide Customer Relationship Management (CRM), billing facility, financial services, and office productivity with email services.

Application Layer is based on cloud architecture at the top level. It is made up of accurate cloud applications. To achieve higher performance, lower running costs, availability, and scalability, cloud systems have essential features. The Platform Layer consists of a structure for operating systems and software. It is designed on top of a layer of infrastructure. The platform layer's primary principle is to reduce the overhead of directly installing applications inside containers of VM. The infrastructure layer gathers processing and storage capacity and uses virtualization methods to partition the physical resources. The cloud's physical resources are controlled through it. Another responsibility of the hardware layer is to manage physical servers, switches, routers, and the power grid [14].

As we know that cloud computing offers many services, a cloud-based solution for organizations and various parts is one of the services called PaaS that helps us to build our own Virtual Machines setup. IaaS gives us the opportunity to build our cloud-based OS and we can do it in our way. The Cloud-Based OS architecture will be described in the next section.

3. CLOUD OPERATING SYSTEM

However, if the fundamental tools it handles are distinct in terms of the functionality it delivers, a cloud OS is identical to a conventional server OS. Next, it offers management systems; likewise, Microsoft azure staff and Amazon EC2 manages. Instead of threads, their Virtual machines contain computing power; they have more computing power. Secondly, it offers database facilities, likewise, blob storage for both Azure and AmzonS3. Thirdly, a cloud-Based operating system offers networking services like a UNIX OS pipe, just like the queue service of Windows Azure and Queue Service (SQS) of Amazon's Easy. A user can perform Pop in and pop-out operations for messages from the front end and backend. Lastly, a cloud-based operating system offers constant computing services, likewise table services of azures and Simple DB of Amzong. In a Windows OS, these vendors provide permanent capacity equivalent to the benefit of the registry. For information on cloud resources, such as EC2, S3, SQS, and SimpleDB, supplied as part of a cloud-based operating system, we directly read on cloud providers' documentation.

For a cloud-based operating system, a significant distinction relative to a server OS is that it is scalable. It is for two purposes. Next, a much larger infrastructure needs to be handled by a cloud OS. Second, instead of just a few people on a PC, a cloud is required to give support to millions of individuals. Cloud vendors are required to develop new systems from the ground up to address the scalability challenges. For example, Google expanded its GFS [15] for file storage, and it's BigTable [16] for vast volumes of semi-structured data to be stored. Similarly, to support its web services API, Amazon built Dynamo [17] to handle storage and develop their management infrastructure.

While it is challenging to incorporate a cloud OS, cloud vendors have now invested a great deal of technical work in creating a largely flexible cloud-based operating system that could handle a vast infrastructure shared by several individuals out of necessity. If we exploit the current cloud OS, we will theoretically reduce the program's functionality and attain high scalability.

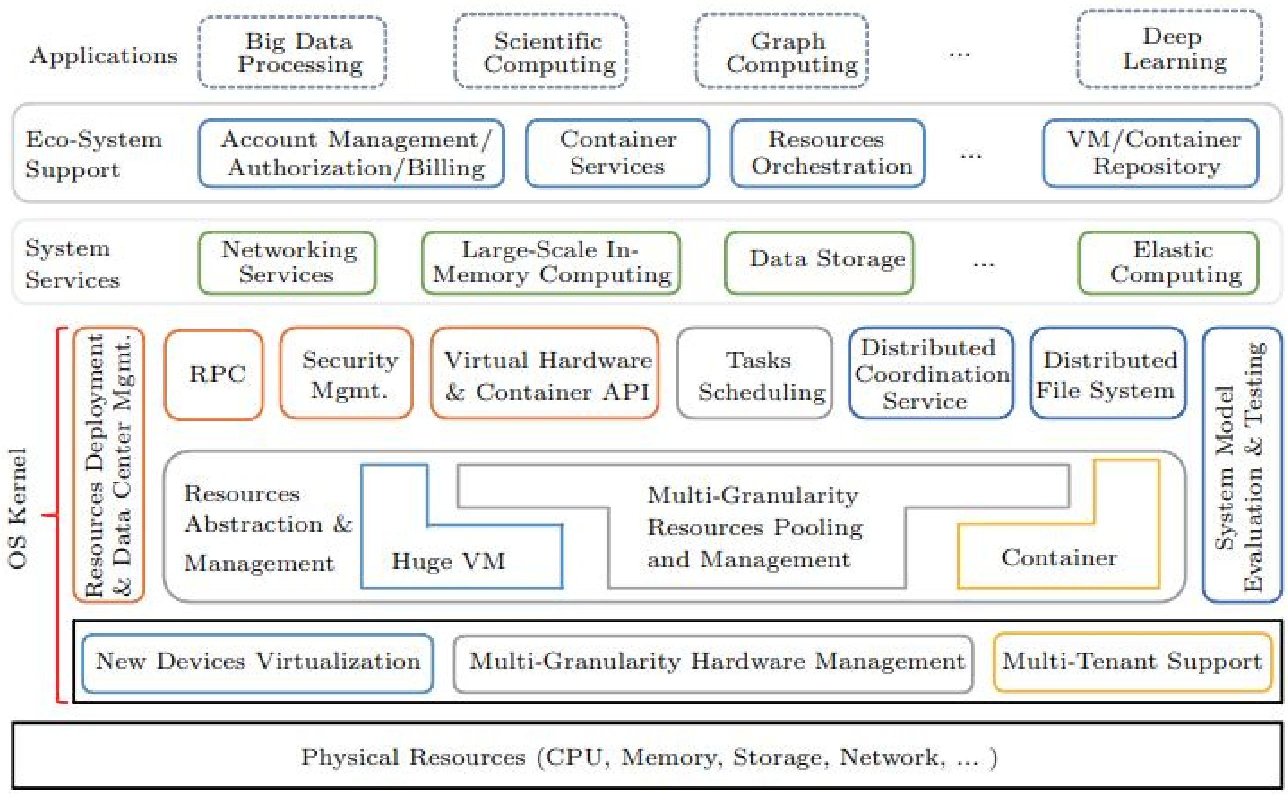

Figure 4: Architectural Diagram of Cloud OS [20].

4. REQUIREMENTS FOR CLOUD-BASED OPERATING SYSTEM

While available datacenter configurations may provide an in-depth full control and omnipresent superintendence capability, the cloud-based environment is often minimum stable and more challenging to handle the environment, therefore, applies many limitations on the architecture of the cloud-based operating system, likewise, depending on coarse-grained awareness of the availability of cloud services, the need to identify and tolerate failures. Following are certain requirements of Cloud OS.

- On behalf of its customers and programs, the Cloud OS would authorize conscious control of its properties.
- Operation of Cloud OS should be carried out while the occurrence of any disaster or any networking problem.
- Cloud OS should be architecture oriented.
- Cloud OS should be platform compatible.
- Cloud OS should manage properly scheduling jobs, resource distribution.
- All characteristics should be like a traditional OS.

4.1 Typical Cloud OS Architecture

The developed and designed cloud OS as a guide that implements the APIs under the auspices of China's National Main Research and Development Program. Figure 4 demonstrates the architecture of our cloud OS.

There are several OS levels, including physical resources, OS kernel, device utilities, support for the eco-system, and applications. The layer of physical infrastructure, including CPUs, disk, space, networking, etc, offers different kinds of services. The OS kernel between the physical resources layer and the system layer helps to resume resources and provide services. Some other resources needed to build an energy-saving include (for example, identity protection, user authorization, accounting, container services, resources instrumentation, and a video/container repository). The top layer is the app layer that offers technology like massive data modeling, mathematical estimation, graph processing, deep learning, and so on.

5. EXISTING CLOUD BASED OS

The cloud operating system plays an essential part in browsing and storing information on the Internet. With regards to the operating system, the cloud and several critical applications share many problems. Table 1 shows all lists of available cloud-based Cloud OS [4].

Table 1: List of different available Cloud Based OS

S. No.	Cloud OS
1	ZIMDESK
2	GHOST
3	MY GOYA
4	JOLI OS
5	CLOUDOS
6	MEGAHA OS
7	MACINE CLOUD
8	GLIDE OS
9	AMOEBA
10	KOHIVE
11	XOS
12	OSV
13	HPCLOUD
14	TRANS OS

6. IMPLEMENTATION CHALLENGES OF CLOUD OS

A cloud OS has its scalability at an expense. It must be exchanged with several other desirable system characteristics. In a motivational lecture at the PODC Conference [18], Mr. Eric Brewer presented the CAP hypothesis. The theory stated that even the data integrity, device availability, and network partition resistance, two of three common system characteristics can be acquired at any particular time. You will find a more formal proof of the CAP theorem in [19]. Since thousands of users use a cloud, it needs to be extremely flexible and continuously available; data integrity is also the only property it can offer.

Indeed, a more impoverished consistency model called "Eventual Consistency" [19] has been implemented by the Amazon cloud OS. With the fully robust model, the framework ensures that all authorization will ultimately back the last modified value if no new changes are made to an object. However, clients will experience inconsistent states over a short time window. It is impossible to determine the size of the inconsistency priority of the window as it is fully dependent on contact delays, the device load, the replication scheme that contains replicas, and the degree of faulted components if any. DNS is a common framework enforcing eventual consistency. Therefore, the name of domain changes are transferred with respect to a configured pattern, and following caches that controlled time; all clients will inevitably use the update.

A cloud also utilizes horizontal scaling in addition to eventual stability. SimpleDB, for instance, can only retain a limited write all over each and every domain (The term domain is the terminology of Amazon schema and can be thought of similar to a database table); however, to maximize the overall write throughput, a user or programmer can program to several domains simultaneously. Since every Amazon account consists of 100 fields by example, further domains can be requested simply by sending an email. It is similar to EC2, which has a maximum of 20 instances by default (The erm Amazon for VM) but can be removed by small and simple email order. These constraints must be solved by creating software on top of a cloud OS.

7. FUTURE DIRECTIONS

The presence of simple but effective, articulate abstractions is important in realizing the full potential of cloud computing. For that reason, the Cloud OS (cloud operating system) has been developed. Cloud OS strives to deliver applications with a broad variety of tools and measurements to facilitate cloud programming thus exposed a coherent single programming interface to the remote hardware underlying the software. This unified framework will allow developers to quickly and transparently manage massively scalable networking and computer environment to deliver secure, elastic, and efficient distributed applications. The next step beyond Cloud OS architecture is to carefully define, firstly, the Cloud kernel-space processes and user space libraries' functional elements and interfaces and secondly, to build and enforce the above objects, with emphasis on tolerance, protection, and the elasticity of defects.

8. CONCLUSION

The Cloud-Based OS's main purpose is to control the cloud tools and allow productive and efficient use of them. And it is also the cloud OS's responsibility to provide users and apps with a simple interface. These two aims, though, are frequently overlapping since convenient abstraction typically takes more energy for computation. Thus, to support multiple cloud programs, the cloud-based OS manage resources and work as a scheduling functionality. The latest development of Cloud-Based OS is driven by these two sometimes competing aims, and it makes every stage of growth happen to find the right tradeoff between them.

In this study, we explored the ways of evolving cloud OS from three separate elements: Cloud OS Architecture, Implementation Challenges, and already built-in Cloud OS. To know about the art of the Cloud OS, a list of difficulties faced when implementing every Cloud OS, a thorough analysis has been carried out.

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