

Private Cloud and Network Convergence

^[1] Shaikh Abdul Azeem, ^[2] Dr. Satyendra Kumar Sharma,

^[1] Research Scholar, ^[2] Dean, Faculty of Engineering,

^{[1][2]} Department of Computer Science

^{[1][2]} Pacific Academy of Higher Education & Research University, Udaipur, Rajasthan, India

Abstract— Internet of Things (IoT) applications are considered to be a major source of big data obtained from a more connected dynamic and real life world and is evolving at a rapid pace. The realization of the IoT vision brings Information and Communication Technology (ICT) closer to many aspects of the real-world life instead of the virtual life through advanced theories, algorithms and applications. Technology of real-world IoT based on cloud computing has rapidly emerged as a novel industry and life pattern. In cloud computing environments that include mobile infrastructures, the most important and final goal is to provide users more secure and richer IoT services. Business problems that enterprises had been facing, such as storage, data security and maintenance costs, cloud is a solution for that. Variations of cloud are public cloud, private cloud. Both public and private cloud have their benefits and downsides, while sharing certain common features. It is possible to calculate the tangible and intangible benefits both forms of cloud offer, and upon analysis, enterprises can decide which type of cloud is more suitable for them. Network convergence provides an evolutionary path to data center modernization rather than being just another costly rip-and-replace solution. In this paper we discuss about private cloud, data centre and network convergence.

Keywords— IoT, Public cloud, Private Cloud, Data Centre, Virtualization, Hybrid Cloud, Cloud Native Architecture, Network Convergence

I. INTRODUCTION

Tremendous advances in algorithms of sensing, processing, communication and actuating core technologies are leading to new intelligent IoT services in our life such as smart cities, smart healthcare, smart grids, and others to improve all aspects of life. Day by day huge demand for these services are getting increased, and providing these intelligence IoT services becoming a challenge, lot of efforts and huge attention is required to take for implementing application technologies and applied algorithms. For implementing these services, application technologies and applied algorithm researchers are facing challenges of context information fusion, security, reliability, autonomous and intelligent connecting, trust application and framework for real-world life. Lot of new technologies, concepts, analysis, reports, experiments, and tutorials are presented by cloud computing based applications and advanced algorithms. All-in-one private cloud solution, which is commonly known as cloud-in-a-box, also called cloud-in-a-can. Cloud-in-a-box is a way to deploy cloud services quickly with a mix of hardware and software that function as a single appliance. Cloud-in-a-box act like a single product, while with common/normal cloud implementation we have face with multiple devices [1].

II. FEATURES OF PRIVATE CLOUD

1. Speed of deployment – Organization can setup

the private cloud not in weeks or months but in some minutes.

2. At old time many hours are required to invest in racking and installing devices in the data center and getting them onto the network.

3. Even a small enterprise customer might have had a few cabinets filled with blinking boxes and a service level agreement that guaranteed that an army of technicians and engineers were looking after the IT infrastructure.

4. Fast forward to today. Smart technology buyers know they can now get all that into one box: compute, storage, network, virtualization and management. It's called superconvergence, and it's the way things are going.

III. NEED OF PRIVATE CLOUD

In the recent past we talked about intranet vs. internet, now same has been replaced with “private cloud vs. public cloud.” If we go through with intranet & private cloud, and with internet & public cloud, we will observe that the underlying principle is same. As we know intranet is the best solution for organizations to implement internal networking services, same way private cloud is the alternate for organizations to protect its data and IT infrastructure. Not only this setting up and managing

private cloud is becoming easier day by day, and space requirements are also getting smaller. In the old days, for building a data center, organizations are requiring to hire experts for everything. Like for router configuration, require router experts, for switches require switching experts, cabling technicians, system administrators, operational support system (OSS) personnel etc.

Subsequently purchasing is require to be done from multiple vendors, quality, compatibility, warrantee, availability & interoperability etc are the major problem to which administrators are require to deal on daily basis. But with advent and development in technologies IT infrastructure building and management is getting too much easier. Experts are no longer required to get your solution into operation. A generalist with basic IT knowledge could do it. A private cloud (cloud-in-a-box) have installed software which is already quality tested and have all components integrated. Because of all these components integration into a single device/place, old problems of quality, compatibility, interoperability, warrantee & availability disappeared.

IV. BENEFITS OF PRIVATE CLOUD

Private Cloud, you have its complete ownership, this is very important advantage of private cloud. If your private cloud architecture is within the secure walls of your campus, then you have complete physical control of it. Because of complete ownership and physical control protection against malware, hacking phishing etc becomes easy, and you can also limit remote access to authenticated users, and other features like configuration, storage, resource management and scalability are firmly under your control. And because you have complete control IT professionals within your IT Infrastructure gets unlimited visibility of every component of your IT Infrastructure. That matters when deeper analysis of usage or performance issues become necessary. In a private cloud, you call the shots. The same benefits of cloud computing in general are present in a private cloud computing environment.

Among the key attributes of the private cloud are flexibility and scalability, the ability to offer resources as services, and resource sharing. Cost savings are realized through standardization and automation. Activities that may have taken weeks can be reduced to hours or minutes through automated processes. The innovation of cloud

computing is transforming the IT industry. The flexibility and protected environment of the private cloud make it easier to customize applications to meet local and national regulations. Security and compliance issues are better handled by the private cloud. Organizations with critical data – especially financial institutions – will find it more amenable to their purposes. Reliability of services is another good reason to go with the private cloud. The risks can be high for customers on the public cloud [2].

V. CLOUD-NATIVE ARCHITECTURE

In normal cloud computing the locations are far from each other, while in a private cloud there are some buildings or sometimes single building also, in this scenario of cloud-native architecture businesses can redesign and improve its infrastructure setup. Cloud-native architecture is built for the cloud, built in the cloud age, and designed specifically to be used via cloud platforms and its container virtualization technology is much compatible with cloud services, this is main reason why organizations should own cloud-native architecture. The process of network virtualization has introduced the dynamic allocation of things like CPU and memory, and a cloud-native design makes use of this philosophy, so in a sense, it makes systems inherently more modern.

VI. PRIVATE CLOUD & VIRTUALIZED DATA CENTER

The terms 'private cloud' and 'virtualized data center' are a good example of that general difference between cloud computing and virtualization. Although cloud computing and virtualization offer some similar benefits, they are two fundamentally different IT philosophies and setups. Unlike cloud computing, infrastructure for private cloud look like a special infrastructure prepared for single client by the cloud vendors. Multitenant strategies are used in public cloud, handling of data and resources is common for all clients, which creates security problems, while with private cloud data goes to remote vendor location through cloud vender, which is fully isolated from other client data. But in virtualization, a network isn't sending data into the cloud at all. Instead, virtualization means that physical hardware pieces are split up by software into individual 'virtual machines.' Virtualization helps make networks more flexible and productive, where these virtual machines get allocated CPU and memory according to what they need. Virtualization may create

better avenues for data and better storage handling, it's not the cloud [3].

VII. PRIVATE VS PUBLIC CLOUD

1. A private cloud platform is a cloud platform that is offered to one customer, and one customer only, while a public cloud platforms serve multiple customers.
2. A private cloud platform is completely walled off from other IT systems serving other customers, while public cloud is global and predictable to all companies.
3. Private cloud platforms offer the customer more control over their own data. Many of these platforms are administrated by IT staff who are on premises at the client company, while public clouds are control & manage by cloud service provider [4].
4. Private cloud platforms involves/provide more security and data control, while data resident on public cloud systems is more vulnerable to unauthorized access.
5. In private cloud, there is no chance of data cross-contamination while in public cloud company serves multiple clients with one architecture which results in multiple things to go wrong.
6. In private cloud infrastructure, one can begin with a known, set cost – no surprise bills. Resources can be scaled up as per need, while in public cloud costs can quickly balloon out of control.
7. Private cloud is ideal infrastructure for business-critical applications, while the public cloud may be used by businesses for enterprise applications.

VIII. SIMILARITIES BETWEEN PUBLIC & PRIVATE CLOUD

1. Both provides the same types of services.
2. Both provide offsite data storage & web-delivered applications.
3. Both provide scalability, on-demand resources, and the ability to provision machines.

IX. HYBRID CLOUD

Elements of public and private cloud are incorporated into a full system. Whole world is now connected with the internet, and every organization is requiring to share lot of data bur not all data. In this scenario Hybrid cloud which is also known as “cloud bursting”, is the good solution. Hybrid cloud is a mix of private and public cloud. With the help of hybrid cloud organizations can keep sensitive data in private cloud and other data on public cloud.

X. THE FUTURE OF PRIVATE CLOUD

Like intranet which look like internet in a bottle, private cloud can also provide the same services like public cloud, but in your own organization infrastructure itself. Now cloud vendors are taking much efforts that private cloud should work and look like a public cloud [5].

XI. PLAYERS IN PRIVATE CLOUD TECHNOLOGY

Sr.	Company	Private Cloud Solution
1.	HPE	Helion CloudSystem hardware, Helion Cloud Suite software
2.	VMware	vRealize Suite Cloud Management Platform, which can manage both private and hybrid clouds.
3.	Dell	virtual private cloud services, cloud management and cloud security software etc
4.	Oracle	Cloud Platform, applications, infrastructure, lifecycle management tools and integration services
5.	IBM	IBM Cloud Managed Services, IBM Storage & IBM Systems hosted private cloud services
6.	Microsoft	Hyper-V virtualization technology, which is integrated into Windows Server & many private clouds
7.	Cloudistics	A unique on-premises cloud platform that gives users the same experience of the public cloud
8.	Cisco	Cisco CloudCenter, Cisco ONE Enterprise Cloud Suite etc
9.	NetApp	NetApp Private Storage (NPS)
10.	Red Hat	Red Hat Cloud Suite management & development platform

Table 1: Players in Cloud Technology

XII. NETWORK CONVERGENCE

Network convergence provides an evolutionary path to modernization rather than being just another costly rip-and-replace solution. That means IT managers can benefit from new technologies and open standards today while also laying a foundation for next-generation cloud computing, just we discussed, both public and private cloud computing [6]. Commonly for data movement we use separate Ethernet local area networks (LANs) or Fibre Channel storage area networks (SANs), but with network convergence single network cable can be used. Network convergence is a strategy for moving storage and server traffic over a single network cable rather than on the separate. As we know there is waste difference between the technologies of SANs and LANs, both these technologies use entirely different protocols, interface cards, cables and management tools, which add to administrative overhead and costs.

In converged network environment organizations may use converged network adapters (CNAs). With the help of CAN's expansion of Ethernet networks that connect to virtualized servers via special 10-Gbps Ethernet pipelines is possible that also support the Data Center Bridging (DCB) standard [7]. The CNA acts as a multi-protocol communications hub among virtualized servers, Ethernet LANs, and network-attached storage (NAS) and iSCSI storage resources. CAN have more capability, Fibre Channel SANs can be embedded into the CAN because of which data flow from virtualized servers is possible. Naturally if lot of media combine into one, which is nothing but convergence enjoy decrease in cost and increase in efficiencies. Because of consolidation of server I/O Single physical infrastructure can carry various types of network traffic.

Large enterprises running virtualized data centers will get the benefits in multiplication. Once they establish a converged, 10-Gbps Ethernet network, IT managers can run their current applications on fewer servers to cut hardware costs and increase utilization rates for higher total cost of ownership. At the same time, IT departments maintain fewer adapters and manage fewer ports, which relieve some of the administrative burdens IT staffs now grapple with. Efficiency-boosting consolidation also reduces physical floor-space requirements and helps

organizations control rising power and cooling costs that can bust a facilities budget. Growing data center challenges created by servers that pack higher numbers of CPUs into each box and run CPUs with ever increasing levels of processing power and fully addressed by Network Convergence. These innovations put new pressures on the network and storage I/O connections that can result in performance bottlenecks. The problem only increases when IT organizations load multiple business applications onto each server to further their server virtualization strategies. Convergence is being fueled by the introduction of next-generation networking technologies and the formalization of new industry standards. High-performance, 10-Gbps Ethernet is becoming the network platform of choice for a growing number of modern data centers.

XIII. REASONS TO CONVERGE

1. Convergence simplifies the physical network, clients, server, and storage infrastructure.
2. Reduces the number of adapters, cables and other lot of connecting devices.
3. Lowers investment cost and administrative costs
4. Cuts server power and cooling costs
5. Increases server utilization
6. Convergence improves Ethernet reliability for storage traffic.

XIV. FUTURE TRENDS

The following trends have been forecast for the coming years for cloud computing by different experts:

1. It is going to be easier to move data to the cloud as self-service grows. For users, it might even be as easy as copy and paste.
2. Cloud analytics, on which organizations will rely at tremendous level who are planning or using cloud.
3. The overall role of IT will shift. As use of Cloud will increase there will be shift in the role of IT from system fixers to innovation brokers. For this tends IT professionals will develop new productivity tools and proactive policies to help enterprises make use of the cloud [8].

XV. NETWORK LIMITATIONS TO CLOUD COMPUTING AND NETWORK CONVERGENCE

A cloud data center sounds good. In which we observe a fully scaled out dynamic virtual data center where applications and virtual servers can move seamlessly to other hosts [9]. Network convergence also sounds good. In which we observe moving of all data center traffic, be it storage, messaging, or voice onto a single network. The problem is that to be successful these two initiatives need to intersect; and when they do, the limitations of the current multi-tiered network become the road block to the fully virtualized and converged network. A new architecture is needed that addresses the network limitations to cloud computing and network convergence [10].

XVI. CONCLUSION

Private cloud, on the other hand, will gradually carve out its own niche at the enterprise level because of its customization and security features. Despite the networking challenges, the fully virtualized or cloud data center is becoming a key initiative in many organizations. Attracted by its flexibility and scalability, IT professionals see it as a way to keep pace with the growing needs of the business. Two key requirements of cloud initiatives are the ability to scale virtual server environments and the ability to provide application mobility. These are the two areas where the traditional, multi-tiered network infrastructure is the most challenged.

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