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ORIGINAL RESEARCH

Hybrid IT and Multi Cloud an Emerging Trend and Improved Performance in Cloud Computing

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Abstract

In the present day scenario cloud computing is an attractive subject for IT and non IT personnel. It is a service-oriented pay per use computational model. Cloud has working models with service-oriented delivery mechanism as well as deployment-oriented infrastructure mechanism. Data centers are the backbone of cloud computing. The massive participation of public has also increased the load on the cloud servers. Proper scheduling of resources is always needed. Quality of service is to be provided as per the service level agreement. Virtualization technique is the main reason behind the huge success of cloud. Multi-cloud exchanges to optimize connectivity today, multi-cloud exchanges offer the next level in direct connectivity, allowing organizations to safely and easily expand multi-cloud capabilities. Exchanges eliminate the added worries that an open Internet can bring as well as the tedious provisioning and configuring that comes with connecting to the public Internet. Importantly, multi-cloud exchanges allow organizations to establish a single connection to multiple cloud providers at the same time through an Ethernet switching platform, rather than wrestling with multiple individual connections to cloud providers.

Keywords Distributed computing · Sophisticated technology · Cloud computing · Virtualization · Scalability · Multi-cloud · Digital revolution · Multiprogramming · Service level agreement · Device independent computing · Location independent computing · Virtualization · Service-oriented architecture

Introduction to cloud technology

Now-a-days a new distributed computing with a name cloud computing has become the most renowned subject of the present innovation. It is the driving force for a greater extent for Google, IBM and Amazon. Many people may think the cloud as a highly sophisticated technology that is invented very recently. Cloud technology is being used for many years. Web services are being provided with internet.

Cloud provides the services. They are being provided in the form of infrastructure, platform and softwares. It is a service-oriented architecture provided with pay-and-use model. It is a technology that provides the applications and services using some distributed network with the help of virtualization technology. This technology has made the recent softwares, platforms and infrastructures to be available at the lesser price to the organizations or private individuals [1].

The digital revolution started in late 1950s and continued to till today. In 1960s job control commands were used in batch processing mode, which has minimized the human interactions in between two jobs to avoid idling situation in between any two jobs for the central processing unit.

Later in 1970s two new concepts were introduced to have better efficiency (i) Multiprogramming and (ii) Timesharing. In multi programming, programs run simultaneously. This has reduced the central processing unit idling. In time sharing for every process a consolidated time is allocated.

In 1980's real-time operating system concept is introduced. To suffice the response time requirement for the external events, real-time scheduling is done [2]. In the

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external events, execution time and response time plays an important role. Execution time is an instance, used up by the job actively utilizing the processor resources and response time is a time in which the job becomes active and completes. The task is a piece of code which will be used inside a single thread execution. Here a time trigger interrupts.

This time trigger interruption is called as an external event. As a result response time is longer than execution time. In 1990s programs are executed in a network. This requires the resources to be utilized by sharing and optimization [3]. In a computer operating system has to perform a variety of functions towards software subsystems and hardware subsystems. Generally, the operating system manages the following resources (i) processor (ii) memory (iii) input output devices and the (iv) files (Fig. 1).

Cloud computing has become a buzz word in the information technology industry. This subscription-based information technology services are provided to its clients with an enforcement of service level agreement (SLA), which assures the clients about the provider's legitimate technological services offered as part of their business [4]. This minimal investment required computing technology is largely available in the open market today which has become a professional tool to tackle many technological challenges. Cloud computing comprised of a front end part and a backend part. Front end part is the user interface and backend is the cloud part.

A user interface is a terminal where the client would access and communicate with the cloud system. Cloud computing has a noble vision such as (i). To provide hardware facility, runtime, and services to every individual (ii).To provide the services without requiring any upfront commitment (iii). To trade as utilities in the open market (iv). To satisfy the end user is a prime motto. Cloud computing has also given a choice to grow up the small software companies. It has also given a scope for the social media also. Face-book, Twitter and Instagram are a few examples for the support taken by cloud computing.

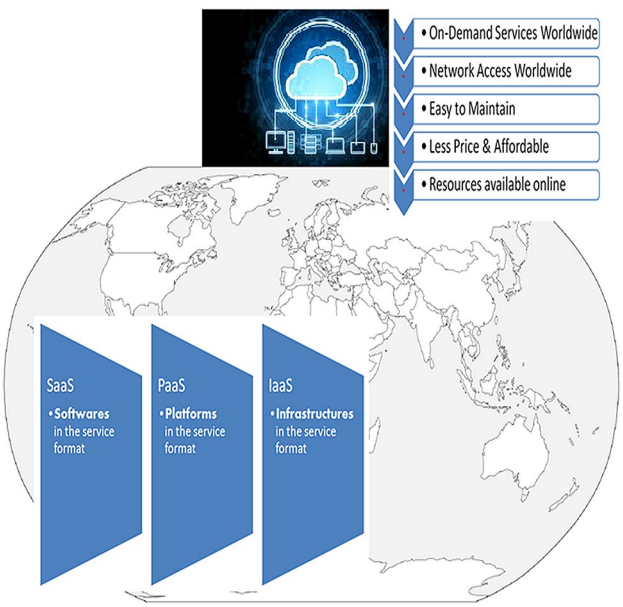

Fig. 1 Cloud computing the era of new model of computing [1]

Now-a-days traditional server rooms, mail servers, firewalls, routers etc are leftover to cloud. Below are some benefits of cloud computing (i). Cloud has reduced the charges towards computing, (ii). Cloud has reduced has made device independent computing, (iii). Cloud has made location independent computing, (iv). Cloud has given huge storage capacity for the users and providers; maximum up to 3000 GB is possible, (iv). Computing power has increased, (v). Software costs are now reduced, (vi). Software installation and updating is possible without any hazards for the users, (vii). Cloud needs high speed internet connection either by broad band or WIFI, (viii). Cloud needs constant internet connection, (ix). Data stored in cloud may not be safe all-time, (x). Vendor lock is a biggest problem in cloud [5].

There are three technologies which work behind the success of cloud computing. They are (i) Virtualization: it shares the resources among the users. (ii) Service-Oriented Architecture (SOA): provides a facility to use the applications as a service irrespective of vendors or technology. (iii) Utility computing: This service model provides computing resources to the end user and the user can manage his part of the infrastructure. Service is an abstract representation of self describing and a piece of code that perform some task. Service is loosely coupled, reusable and programming language independent. Here the word loosely coupled means the cloud computing components which depends on the other cloud computing components that can be easily broken down and modified, and re-used whenever is required.

Cloud computing frameworks are virtualized resources. These resources incorporate virtual machines and virtual components such as servers, memory, network switches, firewalls, load balancers, and storage [6]. Cloud infrastructure components are backend components, hardware elements, for example, multi core servers, constant storage, and large area network devices, switches, routers. Cloud computing infrastructure provides the benefits such as (i) less difficulty to enter (ii) completely flexible (iii) fully scalable (iv) less capital need. Cloud infrastructure has three types of architectures; they are (i) public, (ii) private and (iii) hybrid. Cloud infrastructure is delivered through IaaS (infrastructure as a service) [7].

Cloud Computing and Its Applications

The data center and cloud architectures are keeping on advancing, to address the requirements of expansive scale multi server farms in clouds. These requirements are revolved around seven measurements called (i) scalability, (ii) storage, (iv) bandwidth, (v) speed in network services, (vi) efficiency in memory utilization, (vii) agility in service creation, (viii) cost productivity [8].

a) In cloud computing the clients would have the capability to obtain to their applications, data from anywhere and whenever they need. It needs a distributed computing framework. Data will not be limited to a hard disk on the user's personal computers or enterprise server system.
b) Cloud computing would reduce the equipment costs to a lesser level. Cloud computing architecture will require lesser devices on the user side. It does not require any fastest computer with more memory.
c) Distributed computing frameworks would provide vast accessibility to personal computers applications. The companies need not buy software licenses of every time. The software can be used on a subscription base, provided by the cloud vendor. Generally the softwares are three types such as Free Softwares which are not needed to pay any amount for them to use, but cannot be modified, Ex: Google Apps. The other is Open softwares which are possible to modify and use them, Ex: Apache Tomcat Server. Third is proprietary softwares which are need to purchase and not possible to change, Ex: Ms Office [9].
d) Servers and advanced hardware devices would consume up to room size. A few companies would lease a space to store the servers and their databases since the company does not need to have its accessibility on the location.
e) Software companies can reduce its huge investments on software and hardware using the services of cloud data centers.

There are a variety of solutions available today to enable remote management of distributed IT sites. Specific management goals combined with the number and type of devices to be accessed will help guide the decision as to the type of solution that best meets requirements. Then, evaluating the availability of specific features that deliver value, including software support and compatibility with a broad range of infrastructure and IT systems, will help guide selection of the appropriate vendor. IT management tools generally feature a built-in web interface that allows them to be used without additional software. However, pairing the right software with access and control devices expands their value and enhances their capabilities [10].

Today, more enterprise organizations are moving toward a Hybrid IT infrastructure to increase their agility, reduce total cost of ownership and create overall positive business outcomes. As organizations distribute core business services, application development and data across a hybrid cloud environment, they benefit from the scale, speed and power that such an environment has always promised. Yet, despite the increasing popularity of Hybrid IT for its digital business potential, employing multiple public and private clouds to run essential workflows and applications can still pose significant challenges. Each cloud vendor uses different methods and measures, and will have its own portals, APIs and processes to manage. Provisioning can quickly go sideways without a full understanding of the interrelatedness, dependencies and quirks of each vendor. IT teams need adequate time to ensure interoperability across all cloud providers along with advanced knowledge in areas like container technology, cloud network interconnections and management of cloud native micro services—which may not be feasible for every team to achieve, alongside their daily responsibilities.

Emerging Technologies and Emerging Challenges

The Evolution of Hybrid IT and Multi-Cloud

The time when these cloud computing organizations started initially to migrate towards the applications and workloads to the public cloud, the organizations has come to understand that scalability of the cloud, cost control of the cloud and the cloud computing performance are not need not be optimal with a single cloud provider. And also in this case, the organizations also came to know that it is not every workload belonged in a specific cloud. Then the Organizations started looking for another solution.

They found a solution in which a central network connectivity point, Ethernet switching platforms enables strategic location at the digital edge to bring operations physically closer to cloud providers and end users. Therefore rather than distributing the IT architecture across many data centers, the architecture can be located in the same data center as the cloud providers. As the moment the physical connection into the platform is initiated, then the organization can connect to multiple service providers using the virtual connections. These virtual connections could be on demand. These connections are in real-time connections. The users can use inter site connectivity for the connection to the local clouds and also remote clouds to improve from ambiguities. This has not only improved the efficiency in cloud computing operations and also its has made the network architectures to be simple and ease of use.

The benefits of multi-cloud exchanges include: Multi-cloud exchanges directly connect to all the major public cloud providers: (i) localized traffic. Direct, secure, low-latency interconnection integrates traffic flows, (ii) reduced latency. Customers can see as much as a 45% reduction in latency from direct connection capabilities to public and private clouds, (iii) lower data transit costs. Interconnections within co-located facilities can enable a 60–70% savings in data transfer, (iv) improved security. Point-to-point connectivity that limits the points of network access results in a lower risk of security breaches, (v) on-demand provisioning. Near real-time connection management from a single online portal, (vi) one-to-many connection capabilities. Easy access to cloud services, network providers and other IT service providers through a single port, (vi) direct interconnections. Increased security through private network isolation, making it ideal for performance-sensitive workloads.

Security Challenges

As multi-cloud environments and new business capabilities like artificial intelligence (AI), the Internet of Things (IoT) and augmented reality (AR) gain a foothold in organizations everywhere, data security takes on a new and critical urgency. Strong governance and industry compliance guide the setup and enforcement of security requirements and helps organizations respond effectively should a security breach or data loss occur. But co-location providers play an important part as well, making it imperative that IT teams and data centers work together to lock down operations and minimize risk [11].

Performance Problems

In a distributed environment that includes a combination of public and private clouds, co located on-premises infrastructure, databases and a multitude of SaaS applications, there are many aspects of a multi-cloud strategy that are dependent on the public Internet, which by nature is not always reliable.

The normal latency between cloud provider regions can easily exceed a third of a second, which can lead to customer slowdowns and other problems. When shifting workloads to the public cloud, IT teams have to understand and anticipate the risks around latency and performance to be able to successfully deploy those workloads [12].

Complexity Brings Complications

Managing multiple vendors, ensuring visibility across all applications, securing disparate systems and databases, and controlling spend on co located on premise and cloud infrastructure increases the complexity of a multi-cloud strategy, as the needs and requirements for each vendor have to be configured and integrated into the whole. As complexity multiplies, IT pros face new hurdles in effectively managing, securing and optimizing IT operations. Simplifying Multi-Cloud As multi-cloud IT increasingly becomes the norm across industries and businesses, organizations need a better way to deploy and manage a multi-cloud strategy to reap the full benefits of a hybrid infrastructure while neutralizing some of the complexity.

Internet-Based Challenges

Connectivity can be unreliable. Public Internet often experiences service outages and traffic contention, causing bandwidth fluctuations, increased latency and adverse impacts to critical services and systems. And because there is a limited selection of availability zones, downtime is a constant risk should a failure occur. The shared network link may become oversubscribed. Some cloud providers do not limit network traffic over public internet. This means workloads that are sensitive to network congestion can fall prey to network security weaknesses, latency issues and performance degradation.

Cloud computing can be costly. Since cloud computing requires huge volumes of data, using redundant WAN connections or scaling an ISP can incur significant fees. Cloud data transfer rates are often much higher when data is run over the public Internet rather than through direct connections. Multi-point connections increase the risk of a breach. As those volumes of data get transferred from on premise to the cloud, each point of transfer along the way is a vulnerability and potential point of failure, increasing security risks that can lead to hacks and data breaches. The below are the common issues found in public internet (i) Apps working efficiency to be improved, (ii) data transfer related costs to be minimized, (iii) flexibility is to be attained, (iv) security aspects to be improved (Fig. 2).

Approximately 30% of enterprises connect to clouds via direct interconnection solutions Direct Interconnections for Better Performance and Security As Hybrid IT continues to evolve, cloud providers have increasingly recognized the need for direct connectivity between public and private cloud environments. By directly interconnecting to cloud providers within a co-location facility, end users can now boost performance and reliability, reduces their latency and costs, and increase up security. In view of native on-ramps, Microsoft Azure Express Route, Google Cloud Interconnect, and also AWS Direct Connect the organizations would be able to bypass the public Internet fully with the help of privately and securely connecting to a single public cloud. This makes it to avoid the reliability, performance and also

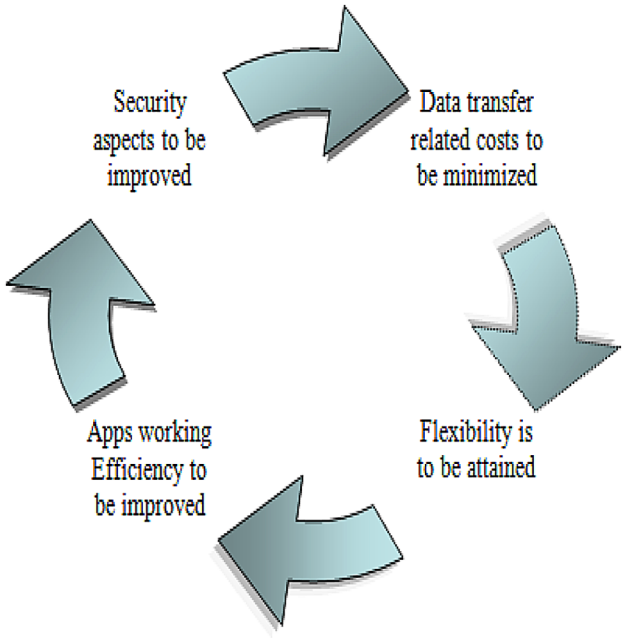

Fig. 2 Issues found in public internet [3]

the security issues which are much common in the public Internet.

Conclusions

To thrive in a Hybrid IT model that's quickly becoming the hallmark of a digital-first economy, modern enterprise organizations need the tools, technologies and co location relationships to not only optimize for business success now, but to future-proof operations with the agility and flexibility needed to meet the evolving business demands of tomorrow. Your organization must depend on the lowest latency, the greatest scale, and the highest levels of security without driving up costs or wasting spend. You also need a multi-cloud strategy that gives you localized connectivity options, a more secure network and access to multiple providers across regions without adding complexity or overloading your existing IT team's management capabilities. Multi-cloud exchanges simplify Hybrid IT while improving performance and security, reducing latency and costs, and keeping your IT operations secure in an ever-changing, ever-expanding digital business world.

Recommendations

Hybrid IT mixes co located on premise and cloud-based IT to combine the security and performance of on-premise facilities with the public cloud's agility, scale and cost savings. As part of a Hybrid IT strategy, organizations can spread workloads and apps such as CRM, ERP and others across multiple clouds for greater flexibility, redundancy, cost management and security.

Future Scope

By employing a multi-cloud approach to hybrid IT, organizations discovered they could: (i) optimize spend by comparing pricing models among vendors, (ii) replicate operations across geographies by leveraging different availability zones (or multiple servers across regions), (iii) increase redundancy and failover, (iv) maximize performance of enterprises now leverage cloud technologies. of enterprises leverage public cloud adoption of enterprises leverage private cloud adoption. In future there is a chance of multi-clouds to become an Omni-cloud.

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