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Cloud Computing: Dissolving Traditional Boundaries

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Abstract - As an emerging technology and business paradigm, Cloud Computing has taken commercial computing by storm. Cloud computing platforms provide easy access to a company's high-performance computing and storage infrastructure through web services. Cloud computing is developed based on grid computing. Cloud computing is changing the way we provision hardware and software for on-demand capacity fulfillment and changing the way we develop web applications and make business decisions.

Keywords: cloud computing, clouds, grid computing, comparison, challenges.

I. INTRODUCTION

Computer has changed our working principle. It solves our problem in time consuming manner. As soon as method to provide services changes, our life becomes easier. Fourth generation's limitation gave birth to fifth generation of computing which is named as Cloud Computing. Cloud computing doesn't limit to grid, parallel and distributed computing. Grid Computing provides resources to the user when user requires. Parallel computing [1] executes the instruction in parallel for fast response to complete user assigned task. Parallel computing provides only fast response neither storage nor memory as a resource. In distributed computing [2], information or data is distributed in the servers situated at different geographical areas. Cloud computing can involve power of such paradigms at any level to form a resource pool.

Cloud computing is an emerging computing technology that uses internet and central remote servers to maintain data and applications. A cloud pools together large numbers of physically distributed compute resources, e.g., processors, memory, network bandwidth and storage, which can be organized on demand into services that can grow or shrink in real-time. [3]This technology allows much efficient computing by centralizing storage, memory, processing and bandwidth. Cloud computing is increasingly popular, owing to its computing-as-a-utility nature, which do not require any upfront equipment cost, relieves administration burden and provides the perception of unlimited resources. Cloud computing have many applications.

Business applications have an incentive for moving into the cloud, to reduce the operational and maintenance costs. The cloud can also be used a platform for scientific discovery, by allowing researchers to develop and run massively scalable scientific applications with little to no up-front investment.

The U.S. military is equipping soldiers with access to military-run cloud computing for "critical surveillance and decision-making information" [4].

Educational institutions are using Facebook and Twitter notifications to broadcast emergency alerts.

Healthcare records and patient monitoring data are moving into the cloud, e.g., by using Microsoft's Amalga, a cloud-based service for storing and accessing patient data [5] Amazon's Northern Virginia data center started having connectivity and failure issues with its Elastic Block Store (EBS), and Elastic Compute Cloud (EC2) instances; while most of the problems were resolved within 24 hours.

II. ARCHITECTURE OF CLOUD COMPUTING

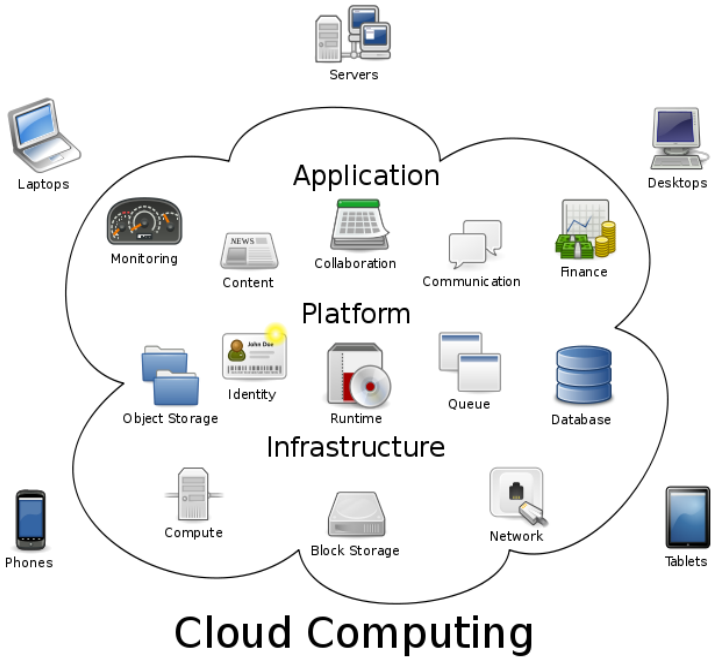
2.1 Service Oriented Architecture (SOA)

Cloud Services represent any type of IT capability that is provided by Cloud Service Provider (CSP) to Cloud Service Customers (CSCs). Typical three levels of abstraction are: infrastructure-as-a-service (IaaS) for running custom software stacks; platform-as-a-service (PaaS) for developing and deploying web-based applications; software-as-a-service (SaaS) for complete applications such as email and document management:

1. Infrastructure as-a- Service (IaaS) provides access to virtualized resources (e.g., CPUs, block storage, key-value stores, SQL databases) and gives customers complete flexibility to run their own software stacks on top of these resources. Examples of IaaS include the Amazon Web Services—e.g., Elastic Compute Cloud (EC2), Simple Storage Service (S3), Elastic Block Storage (EBS)—and the Windows Azure Fabric.

2. Platform as-a-Service (PaaS) provides a middleware service or runtime system on top of IaaS. For example, Windows Azure AppFabric or Google App Engine provide APIs for buildingcustomized applications, including cached datastores, URL fetch, multi-tenant support, component cloning and automated migration for reducing latency.

3. Software as-a-Service (SaaS) provides complete applications that run in the cloud and that are accessed through thin clients (e.g., in a browser). For example, Google Apps for Business provides organizations with cloud services for email, calendar, document storage and collaboration.



III. CLOUD COMPUTING TYPES

3.1 Public clouds

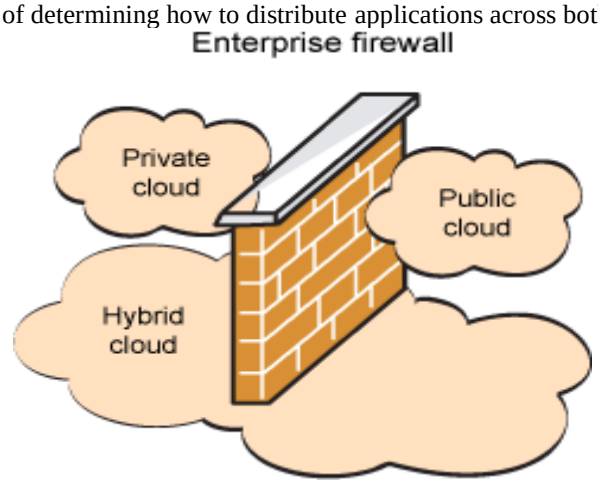
Public clouds are run by third parties, and applications from different customers are likely to be mixed together on the cloud's servers, storage systems, and networks. Public clouds are most often hosted away from customer premises, and they provide a way to reduce customer risk and cost by providing a flexible, even temporary extension to enterprise infrastructure.

3.2 Private clouds

Private clouds are built for the excusive use of one client, providing the highest control over data, security and quality of service. The company owns the infrastructure and has control over applications being provided. Private clouds may be deployed in an enterprise datacenter, and they also may be deployed at a co-location facility.

3.3 Hybrid clouds

Hybrid clouds combine both public and private cloud models. They can help to provide on demand externally provisioned scale. The ability to augment a private cloud with the resources of a public cloud can be used to maintain service levels in the face of rapid workload fluctuations. This is most often seen with the use of storage clouds to support Web 2.0 applications. A hybrid cloud also can be used to handle planned workload spikes. Sometimes called "surge computing," a public cloud can be used to perform periodic tasks that can be deployed easily on a public cloud. Hybrid clouds introduce the complexity of determining how to distribute applications across both a public and private cloud.



VI. THE COMPARISON BETWEEN CLOUD COMPUTING AND GRID COMPUTING

First these two technologies can be compared from job scheduling; the aim of grid computing is to use all kinds of resources. It can divide a huge task in to independent subtasks and crash of any node does not affect the result. While cloud computing is to distribute the computing tasks to many distributed computers, not local computer or remote servers. This can make enterprise pay attention to the application, and visit computer and storage system according to its requirement.

Second, Cloud computing is a model for enabling ubiquitous, 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 [6]. Cloud computing provides basically three kinds of service: Software as a Service (*SaaS*), Platform as a Service (*PaaS*) and Infrastructure as a Service (*IaaS*). While in grid computing resource allocation and handling is done in distributed manner.

V. CLOUD COMPUTING ADVANTAGES

- **Cost Efficiency:** Traditional desktop software and license fees for multiple users, cost companies fortunes in terms of finance. The cloud, on the other hand, is available at much cheaper rates and hence, can significantly lower the company's IT expenses
- **Minimization of storage issues:** Storing information in the cloud gives almost unlimited storage capacity
- **Globalization of workforce:** People worldwide can access the cloud, thereby giving them liberty to work from anywhere in the world
- **Automatic Software Integration:** In the cloud, software integration is usually something that occurs automatically. This means that one do not need to take additional efforts to customize and integrate the applications as per their preferences

VI. CLOUD COMPUTING CHALLENGES

- **Dynamic scalability:** The compute nodes are scaled up and down dynamically by the application according to the response time of the user's queries. The scheduling delays involved are real concern which leads to the need of effective and dynamic load management system.
- **Multi-tenancy:** When the number of applications running on the same compute node increases, it will reduce the amount of bandwidth allocated to each application which may lead to performance degradation.
- **Querying and access:** Scalable provenance querying and secure access of provenance information are open problems for both grid and cloud environment.
- **Standardization:** As every organization has their own APIs and protocols used which makes the user data or vendor lock-in. Thus integration and interoperability of all the services and application is a challenge.
- **Reliability and fault-tolerance:** Tools for testing the application against fault tolerance and compute failures are required which help in developing a reliable system.
- **Debugging and profiling:** Parallel and remote debugging has always been a problem for developing HPC programs and is an issue in cloud computing also.
- **Security and Privacy:** The user has no idea where data is stored and who will use it as there are more hackers than developers [7].
- **Power:** Though cloud computing offers many type of services finally to meet the needs of users, enormous amount of power is consumed. An autonomic energy aware resource management is very much required.

VII. CONCLUSION & FUTURE SCOPE

Cloud computing promises significant benefits, but today there are security, privacy, and other barriers that prevent widespread enterprise adoption of an external cloud. In addition, the cost benefits for large enterprises have not yet been clearly demonstrated. The usage of resources in Cloud Architectures is as needed, sometimes ephemeral or seasonal, thereby providing the highest utilization.

IT industry is optimistic about the future of Cloud Computing but cloud platforms aren't yet at the center of most people's attention. The attractions of cloud-based computing, including scalability and lower costs, are very real. The next generation of application platforms is here which is "cloud; A computing infrastructure on demand."

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