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Cloud Computing: Overview and Current Research Challenges

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Description

Cloud computing is a set of IT services that are provided to a customer over a network on a leased basis and with the ability to scale up or down their service requirements. Usually Cloud Computing services are delivered by a third party provider who owns the infrastructure. Cloud Computing holds the potential to eliminate the requirements for setting up of high-cost computing infrastructure for IT-based solutions and services that the industry uses. It promises to provide a flexible IT architecture, accessible through internet from lightweight portable devices. This would allow multi-fold increase in the capacity and capabilities of the existing and new software. This new economic model for computing has found fertile ground and is attracting massive global investment. Many industries, such as banking, healthcare and education are moving towards the cloud due to the efficiency of services provided by the pay-per-use pattern based on the resources such as processing power used, transactions carried out, bandwidth consumed, data transferred, or storage space occupied etc. In a cloud computing environment, the entire data resides over a set of networked resources, enabling the data to be accessed through virtual machines. Despite the potential gains achieved from the cloud computing, the organizations are slow in accepting it due to security issues and challenges associated with it. Security is one of the major issues which hamper the growth of cloud. There are various research challenges also there for adopting cloud computing such as well managed service level agreement (SLA), privacy, interoperability and reliability. This research paper presents what cloud computing is, the various cloud models and the overview of the cloud computing architecture. This research paper also analyzes the key research challenges present in cloud computing and offers best practices to service providers as well as enterprises hoping to leverage cloud service to improve their bottom line in this severe economic climate. Cloud Architecture, Cloud Computing, Software as a Service (SaaS), Platform as a Service (PaaS), Infrastructure as a Service (IaaS), Mobile Cloud Computing.

Cloud Infrastructure

Internet has been a driving force towards the various technologies that have been developed. Arguably, one of the most discussed among all of these is Cloud Computing. Over the last few years, cloud computing paradigm has witnessed an enormous shift towards its adoption and it has become a trend in the information technology space as it promises significant cost reductions and new business potential to its users and providers. Cloud Computing is an emerging trend to deploy and maintain software and is being adopted by the industry such as Google, IBM, Microsoft, and Amazon. Several prototype applications and platforms, such as the IBM Blue Cloud infrastructure, the Google App Engine, the Amazon Cloud, and the Elastic Computing Platform. Cloud Computing is perceived as the next progression that will impact organizational businesses and how they manage their IT infrastructures. The technology and architecture that cloud service and deployment models offer are a key area of research. Even though there are numerous variations on the definition of Cloud Computing, some basic principles characterize this emerging computing paradigm. Cloud Computing provides technological capabilities generally maintained off premises that are delivered on demand as a service via the Internet. Given that a third party owns and manages public cloud services, consumers of these services do not possess resources in the cloud model but pay for them on a per-use basis. Thus virtualization of the resources is the key concept. In the real scenario, they are renting the physical infrastructure, platforms and applications within a shared architecture. Cloud offerings can vary from virtual infrastructure, computing platforms, centralized data centres to end-user Web-Services and Web applications to enormous other focused computing services. Cloud Computing may be applied to solve problems in many domains of Information Technology like GIS Geographical Information Systems, Scientific Research, e-Governance Systems, Decision Support Systems, Web Application Development, Mobile Technology.

According to U.S National Institute of Standards and Technology (NIST), Cloud Computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources networks, servers, storage, applications, and services that can be rapidly provisioned and released with minimal management effort or cloud provider interaction. In simple words, Cloud Computing is the combination of a technology, platform that provides hosting and storage service on the Internet. In such an environment users need not own the infrastructure for various computing services. In fact, they can be accessed from any computer in any part of the world. This integrates features supporting high scalability and multitenancy, offering enhanced flexibility in comparison to the earlier existing computing methodologies. It can deploy, allocate or reallocate resources dynamically with an ability to continuously monitor their performance. Moreover, cloud computing minimizes the capital expenditure. This approach is device and user-location independent. Main goal of the cloud computing is to provide scalable and inexpensive on-demand computing infrastructures with good quality of service levels. Cloud Computing is a general term for anything that involves delivering hosted services over the Internet. Instead of a static system architecture, Cloud Computing supports the ability to dynamically scale up and quickly scale down, offering cloud consumers high reliability, quick response times, and the flexibility to handle traffic fluctuations and demand. Cloud computing also supports multi tenancy, providing systems configured in such a way that they can be pooled to be shared by many organizations or individuals. Virtualization technology allows cloud vendors to convert one server into many virtual machines, thereby eliminating client-server computing with single-purpose systems. This maximizes hardware capacity and allows customers to leverage economies of scale. Benefits of Cloud computing are enormous. The most important one is that the customers don't need to buy the resource from a third party vendor, instead they can use the resource and pay for it as a service

thus helping the customer to save time and money. Cloud is not only for Multinational companies but it's also being used by small and medium enterprises.

Private Cloud

Private cloud is a new term that some vendors have recently used to describe offerings that emulate cloud computing on private networks. It is set up within an organization's internal enterprise datacenter. In the private cloud, scalable resources and virtual applications provided by the cloud vendor are pooled together and available for cloud users to share and use. It differs from the public cloud in that all the cloud resources and applications are managed by the organization itself, similar to Intranet functionality. Utilization on the private cloud can be much more secure than that of the public cloud because of its specified internal exposure. Only the organization and designated stakeholders may have access to operate on a specific Private cloud. One of the best examples of a private cloud is Eucalyptus Systems. Public Cloud, Public cloud describes cloud computing in the traditional mainstream sense, whereby resources are dynamically provisioned on a fine-grained, self-service basis over the Internet, via web applications web services, from an off-site third-party provider who shares resources and bills on a fine-grained utility computing basis. It is typically based on a pay-per-use model, similar to a prepaid electricity metering system which is flexible enough to cater for spikes in demand for cloud optimization. Public clouds are less secure than the other cloud models because it places an additional burden of ensuring all applications and data accessed on the public cloud are not subjected to malicious attacks. Examples of a public cloud include Microsoft Azure, Google App Engine. Hybrid Cloud Hybrid cloud is a private cloud linked to one or more external cloud services, centrally managed, provisioned as a single unit, and circumscribed by a secure network. It provides virtual IT solutions through a mix of both public and private clouds. Hybrid Cloud provides more secure control of the data and applications and allows various parties to access information over the Internet. It also has an open architecture that allows interfaces with other management systems. Hybrid cloud can describe configuration combining a local device, such as a Plug computer with cloud services. It can also describe configurations combining virtual and physical, collocated assets for example, a mostly virtualized environment that requires physical servers, routers, or other hardware such as a network appliance acting as a firewall or spam filter. An example of a Hybrid Cloud includes Amazon Web Services.