

A Comparative Study of cloud and mCloud Computing

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Abstract:

Cloud Computing is one of the latest technology. It makes many changes in industry. It is a platform which includes technology, resources and infrastructure. It is a concept of sharing resources to achieve economical benefit. It allows to store and retrieve files and folders in cloud area from anywhere in the world. In advanced, Mobile Computing is the combination of cloud Computing and Mobile devices. It has become more popular in present decades. Mobile computing is different from regular cloud computing in different levels. It allows carrying physical devices which helps in telework. This paper tries to give details about cloud and mobile computing, its architecture, services, characteristics and applications. Here a comparison for cloud computing and MCC has been given which helps the readers to understand the differences. In addition to it future research areas in cloud and MCC is discussed.

Keywords: Cloud Computing, Mobile Cloud Computing (MCC), Resource, Technology.

I. Introduction

Cloud computing is a platform which allows the user to use files and application in internet. It is more efficient because the storage, memory, processing are centralized [1]. The name comes from the cloud shaped symbol. It is a third-party network hosted on the internet to store and manage the data, rather than locally. Cloud provides various services which are very popular because of its comfortable and convenient memory storage. Instead of running the programs and data in the pc, those can be hosted in cloud. Here any document can be accessed from anywhere in the world [3] through internet which makes us to work from different places and with different people.

A. Characteristics of Cloud Computing

Resource abstraction and pooling

Pooled computing resources serve multiple consumers using a multi-tenant model with physical and virtual resources dynamically assigned and reassigned depending on demand. The consumer of the service generally is able to specify location at a higher level of abstraction such as to create high availability which includes storage, processing, memory, network bandwidth, and virtual machines [8].

Network-centric

Cloud Computing is network-centric. Services are made available over the network and accessed through standard mechanisms, typically lightweight web protocols [8].

Simple, fast provisioning of resources

One of the ways that cloud computing makes an IT infrastructure more agile is by enabling new resources to be brought online quickly. A user can stipulate computing capabilities as needed, without having to interact with a human although this access may be under policy based automated control [8].

Rapid and elastic scaling

In a cloud environment, resources can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out based on preset policies and the demands of an application. Just as important, resources can also be rapidly decreased when they are no longer needed; avoiding the familiar situation of unused servers sitting idle after the task they were initially purchased for ends [8].

Utility pricing

Cloud computing is sometimes associated with utility pricing, which is at the primary billing approach used by public cloud providers. Metering at a level of abstraction appropriate to the type of service may become more widespread over time as organizations learn the types of data that are most useful, whether or not the information is used for billing or just for informational purposes [8].

On Demand Capabilities

Services can be accessed on demand by paying money for what they use.

Broad Network Access

Any kind of devices can be used to access cloud services.

Measured Services

Resource usage can be measured and reported to cloud service providers and customers frequently.

Wireless

As mobile devices are used to access cloud services, data can be accessed anywhere anytime.

B. Cloud Architecture

Cloud computing is the interconnection of servers in a grid which combines the resources to provide faster access, vast amount of computing power and large memory. It is controlled by third party in one or more places. User can access cloud by connecting their pc or portable devices in internet. Cloud computing utilizes the network as a means to connect user end point to resources that are centralized in a data centre. The data centre may be accessed via the internet or a company network, or both. A user endpoint with minimal software requirements may submit a task for processing. The service provider may pool the processing power of multiple remote computers in "the cloud" to achieve the task, such as data warehousing of hundreds of terabytes, managing and synchronizing multiple documents online or computationally intensive work.

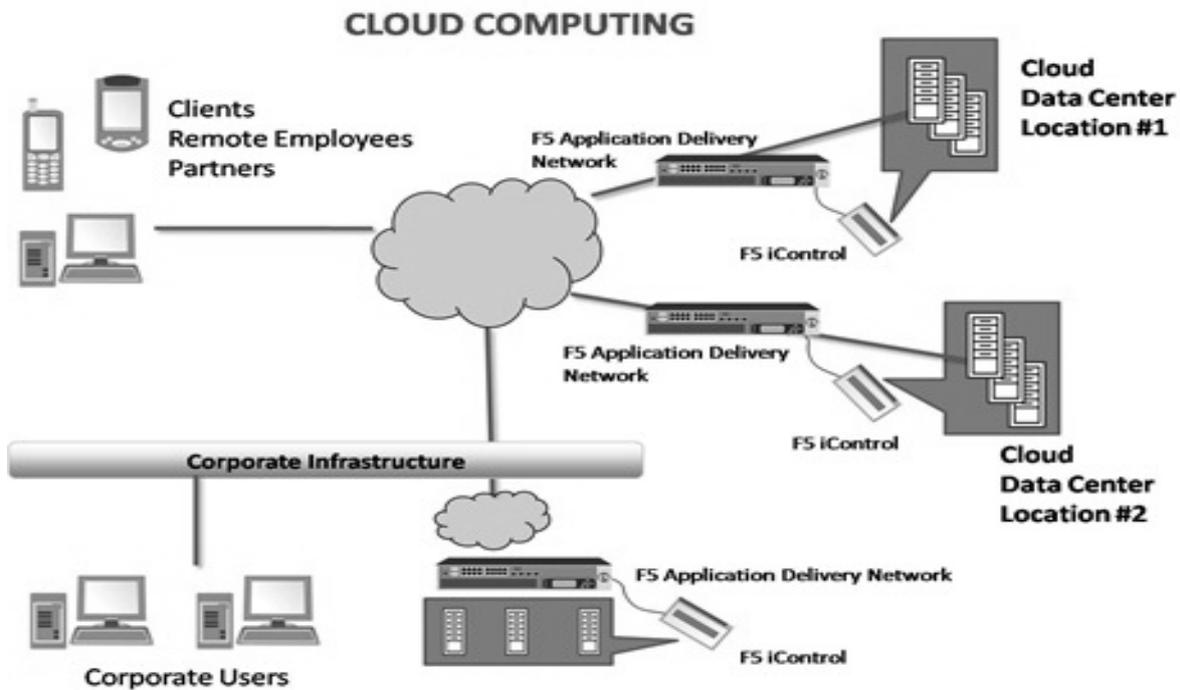


Figure 1. Cloud Architecture

C. Cloud Services

A company can use cloud computing in different ways for its application.

1. Software as a Service
2. Platform as a Service
3. Infrastructure as a Service

Software as a service (SaaS)

In SaaS, the application or software is installed in cloud; users can access these applications by paying money.

Platform as a Service (PaaS)

The cloud provider offers the development environment such as operating system, database, programming language as a service. User can use this environment to develop their own application.

Infrastructure as a Service (IaaS)

Here the cloud providers install virtualized environment such as virtual server space, network connection, IP addresses, Load balance and bandwidth in cloud so that the user use the services to develop the applications.

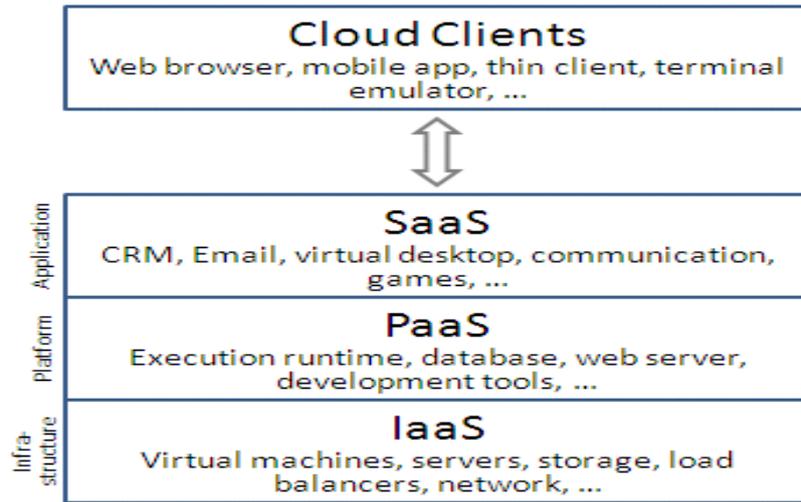
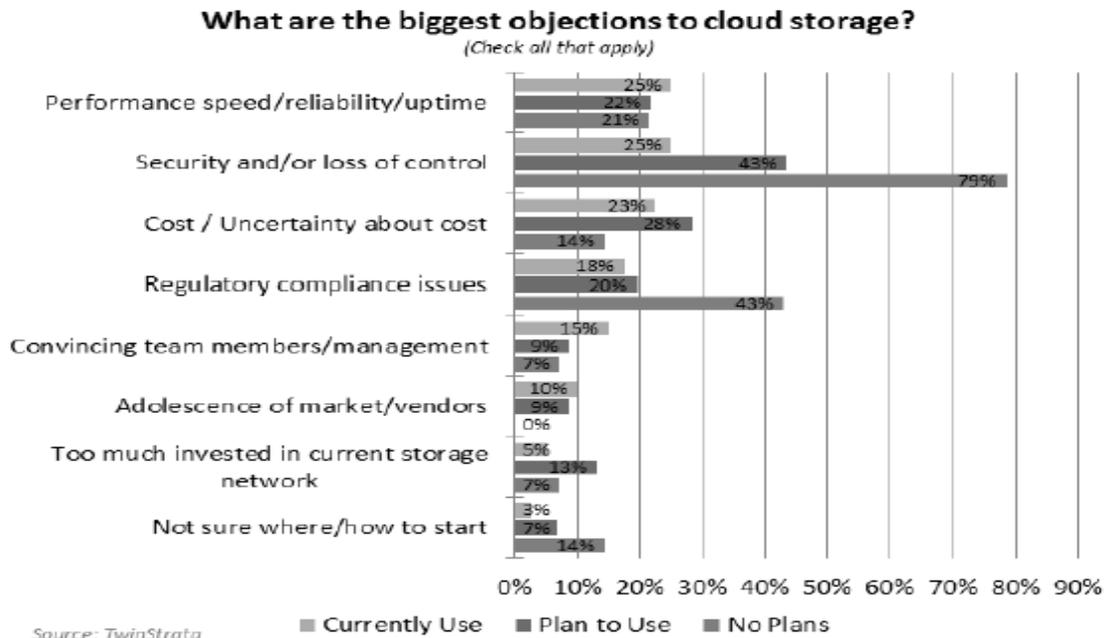


Figure 2. Cloud Services

D. Cloud Data Management

A database has to be implemented in cloud to store and retrieve data. Data files are stored in multiple virtual servers. The servers are hosted by third party companies [6] are used to store and retrieve data. Users have to pay amount to use data storage. Although cloud computing provides resources and services to user, the data stored in cloud database has various risks. Figure 3 shows various risks in cloud storage.



Source: TwinStrata

Figure 3. Cloud Data Management

E. Applications of Cloud Computing

The applications of cloud computing are practically limitless. With the right middleware, a cloud computing system could execute all the programs a normal computer could run. Potentially, everything from generic word processing software to customized computer programs designed for a specific company could work on a cloud computing system.

F. Mobile Cloud Computing

Mobile Computing is the combination of Cloud Computing and Mobile networks. Mobile cloud computing is gaining stream. According to the latest study from Juniper Research, the number of mobile cloud computing subscribers is expected to grow rapidly in the next five years [2].

G. Mobile Cloud Architecture

Mobile devices are connected to the mobile networks via base stations that establish and control the connections and functional interfaces between the networks and mobile devices. Mobile users' requests and information are transmitted to the central processors that are connected to servers providing mobile network services. The subscribers' requests are delivered to a cloud through the Internet. In the cloud, cloud controllers process the requests to provide mobile users with the corresponding cloud services.

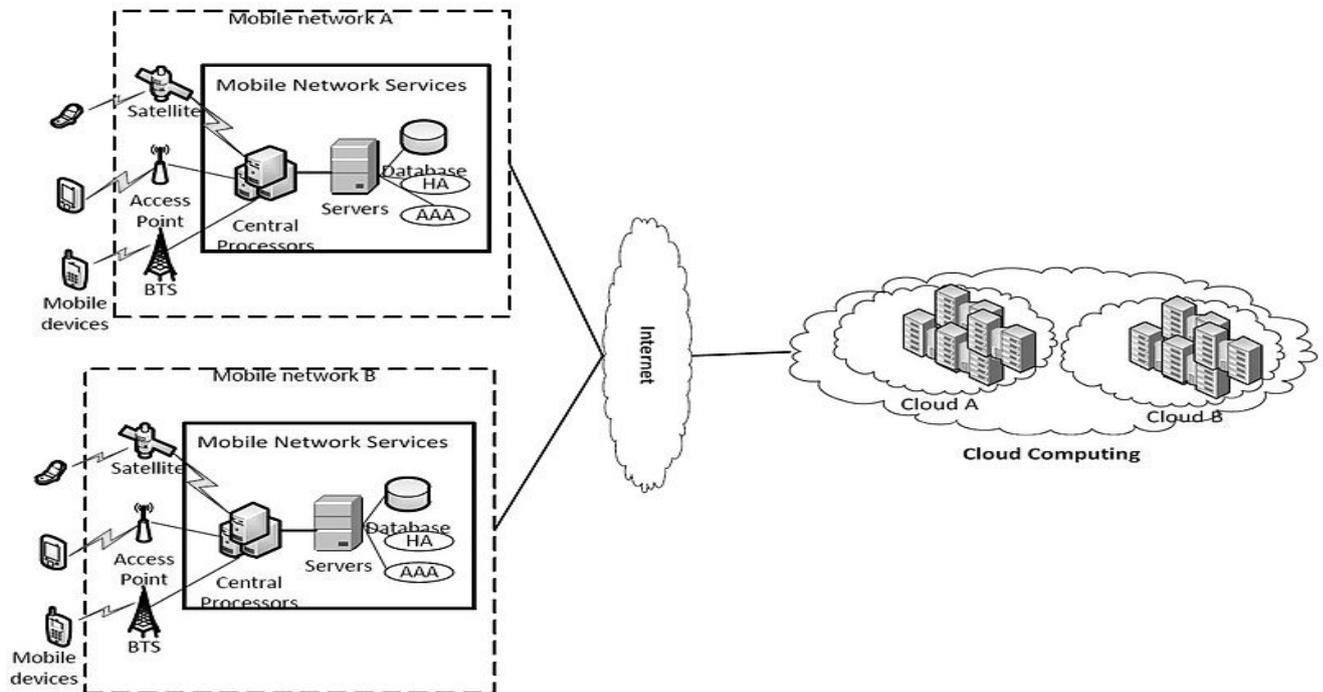


Figure 4. Mobile Cloud Computing Architecture

H. Applications of Mobile cloud Computing

Mobile Commerce

Mobile Commerce is carried out with the help of mobile devices. Mobile Commerce can be combined with cloud computing to overcome the issues of lower bandwidth, device difference and security [7].

Mobile Learning

A cloud with larger space can be utilized for electronic learning.

Mobile Healthcare

Mobile Healthcare with cloud helps patients to access their records easily and quickly.

Mobile Gaming

Gaming in cloud helps the user to play with the interactive screen instead of loading all multimedia coding [7].

I. Characteristics

Extending battery lifetime

Computation offloading migrates large computations and complex processing from resource limited devices to resourceful machines. Remote application execution can save energy significantly. Many mobile applications take advantages from task migration and remote processing.

Improving data storage capacity and processing power

MCC enables mobile users to store and access large data on the cloud. MCC helps to reduce the running cost for computation intensive applications. Mobile applications are not constrained by storage capacity on the devices because their data now is stored on the cloud.

Improving reliability and availability

Keeping data and application in the cloud reduces the chance of lost on the mobile devices. MCC can be designed as a comprehensive data security model for both service providers and users. The data and services are present in cloud so the user can use it when they are moving.

Dynamic provisioning

Dynamic on-demand provisioning of resources on a fine-grained, self-service basis. No need for advanced reservation.

Scalability

Mobile applications can be performed and scaled to meet the unpredictable user demands. Service providers can easily add and expand a service.

Multitenancy

Service providers can share the resources and costs to support a variety of applications and large number of users.

Ease of Integration

Multiple services from different providers can be integrated easily through the cloud and the internet to meet the users' demands.

II. Difference

A. Storage

In Cloud storage, large space is given for lease or buy. The storage and resources are virtualized where the customer will store and retrieve data.

Mobile Cloud Storage provides various services to store and retrieve files, music, photos by mobile devices. Providers offer free use of storage for limited period and charge for additional use. Data storage and retrieval is done with the help of mobile devices [4].

B. Network

When a mobile application uses mobile cloud, it becomes sensitive to network latencies because of distance from server than cloud computing [5].

C. Dependency

In Mobile cloud computing the mobile application are fully dependent on cloud than that of other applications.

D. Device Difference

Each mobile device comes with different configuration so the user has to understand the customization to use cloud.

E. Operation

Sometimes mobile devices can go out of range while they are in operation. But it will not happen in cloud computing.

F. Fault tolerant

When mobile devices go out of range, the connection will get disconnected. So it is must to develop cloud with monitoring facility which intimates user about disconnection.

G. Limited Energy

The mobile cloud needs to be mindful of the limited energy availability on mobile devices and may need to perform all functions on the side of the cloud, rather expecting them to be done on the mobile devices.

H. Expanded testing capabilities

The mobile cloud needs to have additional testing capabilities that allow testing for poor network latency, unreliable and intermittent communication with the mobile device, disconnected operation and subsequent synchronization of data with the application on the mobile devices.

I. Energy-efficient transmission

Mobile cloud computing requires more transmission between cloud and mobile devices, so the transmission must be careful.

Table 1 shows the difference between cloud and mobile cloud computing

Characteristic Difference	Cloud Computing	Mobile cloud Computing
Storage	Stores data in cloud, some processing are done in cloud.	Processing and storage happens outside the mobile devices.
Network	Sensitive to network latencies.	Sensitive to network latencies.
Dependency	Only few applications depend on cloud.	All mobile applications are fully dependent on cloud.
Device Difference	Low device difference.	Each mobile comes with different configuration. So difficult to understand.
Operation	The operations are carried out by transferring data from cloud to users through network.	While data transmission, there is a possibility to go out of range.
Fault Tolerant	Faults can be identified and rectified without difficulty.	Faults (out of range) in the mobile devices has to be intimated to user at proper time.
Limited Energy	More energy required when compared to mobile devices.	Limited energy is sufficient because all processing done outside the mobile devices.
Expanded Testing Capabilities	Testing needed and it can be done easily.	Needs more testing capabilities as the communication has more tribulations.
Energy Efficient Transmission	Data transmission between cloud and static devices.	More transmission between cloud and mobile devices as it is in movement.

Table 1. Difference between Cloud and Mobile Cloud computing

III. Issues

5.1. Privacy

As the data is stored in remote area, there is a possibility of stealing the information without user's permission.

5.2. Data Ownership

This problem arises when purchased files are stored in cloud area.

5.3. Security

If the devices are unprotected, data can accessed by unauthorized persons.

IV. Research Area

- Data management in the cloud
- Hybrid human-machine data management systems
- Infrastructure for cloud-scale analytics and machine learning
- New consistency and concurrency control models
- Data streams/continuous analytics
- XML query processing
- Elasticity for Cloud Data Management Systems
- Resource and Workload Management in Cloud Databases
- Multi tenancy
- High Availability and Reliability in Cloud Databases
- Cloud computing infrastructures design for cloud data services
- Transactional models for Cloud Databases
- Distributed and Massively Parallel query processing

- Storage architectures and technologies for cloud databases
- Privacy and security in cloud data management
- Mobile cloud data management
- Cross-platform interoperability
- Service-level agreements
- Economic/business models, and pricing policies
- Novel data-intensive/data-rich computing applications
- Virtualization and Cloud Databases

V. Conclusion

Cloud computing and Mobile Cloud computing are becoming more popular in the present decades which provides more optimal services for users. Both the technologies are more over similar with slight differences. These differences are in the areas of energy, network, and connectivity of mobile devices. Mobile Application needs more accessibility from mobile cloud rather than cloud computing. Apart from these differences, mobile computing contains some additional features. This article provides details about cloud and mobile cloud computing, its difference and gives details about research criteria in this area.

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