Introduction:

Cloud computing:

The cloud computing is a new computing model which comes from grid computing, distributed computing, parallel computing, virtualization technology, utility computing and other computer technologies and it has more advantage characters such as large scale computation and data storage, virtualization, high expansibility, high reliability and low price service. Cloud computing is the use of hardware or software resources that are delivered as service over network. The name cloud comes from the use of cloud shaped symbol as an abstraction to define complex infrastructure.

Benefits of Cloud computing:

- **Reduce capital costs:** There’s no need to spend big money on hardware, software or licensing fees.
• **Reduce spending on technology infrastructure:** Maintain easy access to your information with minimal upfront spending. Pay as you go (weekly, quarterly or yearly), based on demand.

• **Improve accessibility:** You have access anytime, anywhere, making your life so much easier.

• **Minimize licensing new software:** Stretch and grow without the need to buy expensive software licenses or programs.

• **Streamline processes:** Get more work done in less time with less people.

**Service Models:**

Cloud computing providers offer their services according to several fundamental models.

• **Infrastructure as a service (IaaS):**
  
  In this cloud-service model, providers of IaaS offer computers - physical or virtual machines - and other resources. Infrastructure as a Service is a provision model in which an organization outsources the equipment used to support operations, including storage, hardware, servers and networking components. The service provider owns the equipment and is responsible for housing, running and maintaining it. The client typically pays on a per-use basis.

• **Characteristics and components of IaaS include:**

  • Utility computing service and billing model.
  • Automation of administrative tasks.
  • Dynamic scaling.
  • Desktop virtualization.
  • Policy-based services.
  • Internet connectivity.

Examples of IaaS providers include: Amazon EC2, Azure Services Platform, DynDNS, Google Compute Engine, HP Cloud, iland, Joyent, LeaseWeb, Linode, NaviSite, Oracle Infrastructure as a Service, Rackspace Cloud, ReadySpace Cloud Services, ReliaCloud, SAVVIS, SingleHop, and Terremark.

• **Platform as a service (PaaS):**

  In the PaaS model, cloud providers deliver a computing platform typically including operating system, programming language execution environment, database, and web server. Application developers can develop and run their software solutions on a cloud platform without the cost and complexity of buying and managing the underlying
hardware and software layers. With some PaaS offers, the underlying computer and storage resources scale automatically to match application demand such that cloud user does not have to allocate resources manually.


- **Software as a service (SaaS):**
  In the SaaS model, cloud providers install and operate application software in the cloud and cloud users access the software from cloud clients. Cloud users do not manage the cloud infrastructure and platform where the application runs. This eliminates the need to install and run the application on the cloud user's own computers, which simplifies maintenance and support. Cloud applications are different from other applications in their scalability—which can be achieved by cloning tasks onto multiple virtual machines at run-time to meet changing work demand. Load balancers distribute the work over the set of virtual machines. This process is transparent to the cloud user, who sees only a single access point. To accommodate a large number of cloud users, cloud applications can be multitenant, that is, any machine serves more than one cloud user organization. It is common to refer to special types of cloud based application software with a similar naming convention: desktop as a service, business process as a service, test environment as a service, communication as a service.

Examples of SaaS include: Google Apps, Microsoft Office 365, Onlive, GT Nexus, Marketo, and TradeCard.

**Deployment models:**

**Public cloud**
Public clouds are simple internet based clouds and they are accessible publicly. Even public domain users can also use the services provided by the public clouds. The type of services provided by the public clouds includes some public documents, file sharing and database storing for normal users. Few public web services are provided across the public clouds and passing the
required arguments will make the cloud accessible. Pay per usage process is followed across the public clouds and there are many third parties available to provide the public access to these clouds.

**Private clouds**
Private networks are used across maintaining the private clouds. In general one or more organizations will make use of these private clouds and they need a separate network to access the same. Few access level restrictions are imposed over these private clouds and a perfect pass of these restrictions is required to access the private clouds. Private clouds are owned by a single organization and they use their own private network domains to provide the required services.

**Community clouds**
When two or more organizations are in need of similar requirements they form together and create the community cloud. These organizations will share the common infrastructure and computational power of the cloud. Community clouds are really useful when it comes to group level requirement for a group of organizations.

**Combined cloud**
Two or more clouds with different nature of operation are combined together and referred as combined clouds. When a single cloud can’t handle the client requirements, these combined clouds are used to accomplish the required job. Integrated level of services is provided by this type of clouds and the level of integration is complex enough in this case.

**Hybrid clouds**
When a type of service can’t be provided by simple private or public clouds, hybrid clouds are used by the organizations. High end and complex tasks are accomplished by these hybrid clouds. Complex business needs of the organizations are solved by these hybrid clouds and the main limitation with this type of clouds is its complex nature.

**Ad-hoc network:**

**Definition:** “Ad Hoc network is a self-organizing multi-hop wireless network, which relies neither on fixed infrastructure nor on predetermined connectivity”.
The decentralized nature of wireless ad-hoc networks makes them suitable for a variety of applications where central nodes can't be relied on, and may improve the scalability of wireless ad-hoc networks compared to wireless managed networks, though theoretical and practical limits to the overall capacity of such networks have been identified.
Minimal configuration and quick deployment make ad hoc networks suitable for emergency situations like natural disasters or military conflicts. The presence of dynamic and adaptive routing protocols enables ad-hoc networks to be formed quickly.

**Protocols used for ad-hoc network:**

![Diagram of ad-hoc routing protocols]

**Ad-hoc Cloud network:**

**Ad-hoc cloud computing** means allow cloud services to run on existing heterogeneous hardware. In other words running cloud services on ad-hoc network. Computational and storage resources within organizations are often under-utilized. By using this concept we can increase the utilization of general purpose computers & other hardware devices. We propose to introduce a model in which various cloud models IaaS or SaaS distributed over an ad-hoc network machines. By ad-hoc we mean that set of machines comprising the cloud changes dynamically. Participating machines is not dedicated to the clouds. But that machine can be used for other primary purpose.

The availability of ad-hoc clouds has many benefits; some of them are listed below:
- Reduce number of machines that need to be purchased;
- Reduced cost of hardware
- Reduced infrastructure cost
- Reduced overall power consumption.
- Easy to manage data
- Easy to data recovery an disaster management