CH-8 Emerging Technologies

Some pertinent similarities are highlighted as follows:

CLOUD COMPUTING	GRID COMPUTING
scalable	scalable
multi-tenancy and multitasking	multi-tenancy and multitasking
provide Service- Level Agreements (SLAs)	provide Service- Level Agreements (SLAs)

Some pertinent differences are highlighted as follows:

CLOUD COMPUTING	GRID COMPUTING
store objects as small or even several terabytes.	suited for data-intensive storage (only large)
focuses on computationally intensive operations	two types of instances: standard and high-CPU.

Goals of Cloud Computing

To meet the requirements, some of the pertinent objectives in order to achieve the goals are as follows:

1. To create a highly efficient IT ecosystem,
where resources are pooled together and

costs are aligned with what resources are actually used.

2. To scale the IT ecosystem quickly, easily and cost-effectively based on the evolving business needs.

3. To reduce costs related to IT energy/power consumption.

4. To consolidate IT infrastructure into a more integrated and manageable environment.

5. To access services and data from anywhere at any time.

6. To enable or improve "Anywhere Access" (AA) for ever increasing users and rapidly provision resources as needed.

Cloud Computing Architecture

A cloud computing architecture consists of a Front End and a Back End.

The front end is the side, the computer user sees and interacts through, and the back end is the “cloud” section of the system, truly facilitating the services

They connect to each other through a network, usually the Internet.

Front End Architecture:

The front end of the cloud computing system comprises of the client’s devices (or computer network) and some applications needed for accessing the cloud computing system.

All the cloud computing systems do not give the same interface to users.

Web services like electronic mail programs use some existing web browsers such as Firefox, Microsoft’s internet explorer or Apple’s Safari.

Other types of systems have some unique applications which provide network access to its clients.

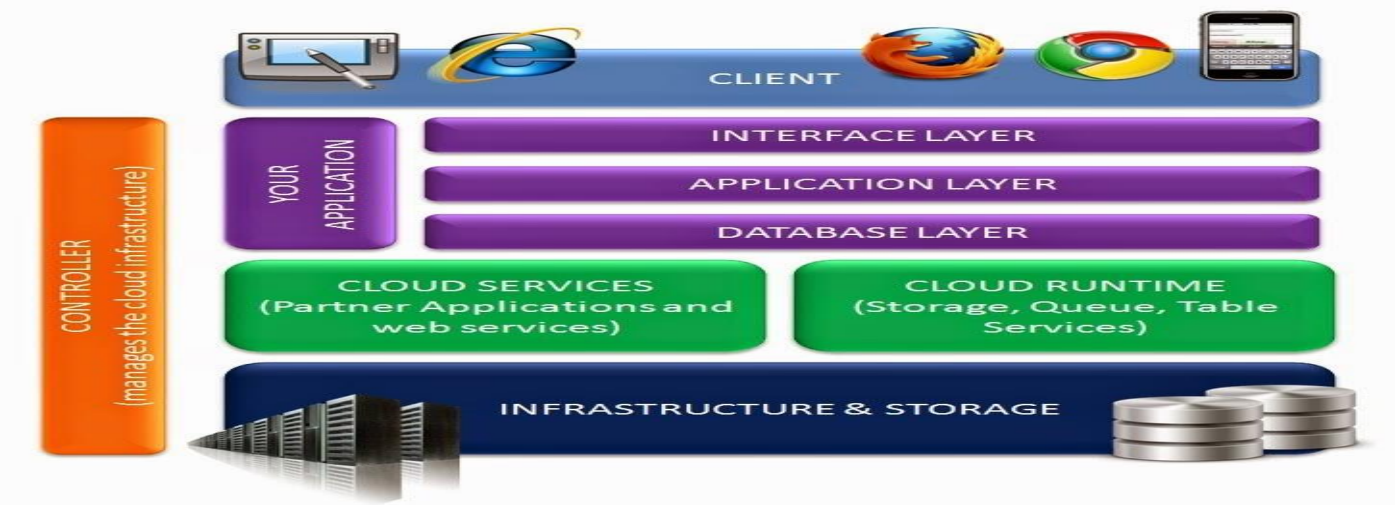
Back End Architecture:

Back end refers to some service facilitating peripherals.

In cloud computing, the back end is cloud itself, which may encompass various computer machines, data storage systems and servers.

Groups of these clouds make up a whole cloud computing system.

Theoretically, a cloud computing system can include any type of web application program such as video games to applications for data processing, software development and entertainment.



Cloud Computing Environment

The Cloud Computing environment can consist of multiple types of clouds based on their **deployment** and usage.

1. Private Cloud
2. Public Cloud
3. Community Cloud
4. Hybrid Cloud

1. Private Cloud

This cloud computing environment resides within the boundaries of an organization and is used exclusively for the organization's benefits.

These are also called Internal Clouds or Corporate Clouds.

Private Clouds can either be managed by the single organization (On-Premise Private Cloud) or can be managed by third party (Outsourced Private Cloud).

They are built primarily by IT departments within enterprises, who seek to optimize utilization of infrastructure resources within the enterprise by provisioning the infrastructure with applications using the concepts of grid and virtualization.

Certain characteristics of Private Cloud are as follows: (SSW)

Secure: The private cloud is secure as it is deployed and managed by the organization itself, and hence there is least chance of data being leaked out of the cloud.

Self-Central Control: As usual, the private cloud is managed by the organization itself, there is no need for the organization to rely on anybody and its controlled by the organization itself.

Weak Service Level Agreements (SLAs): SLAs play a very important role in any cloud service deployment model as they are defined as agreements between the user and the service provider in private cloud.

In private cloud, either Formal SLAs do not exist or are weak as it is between the organization and user of the same organization. Thus, high availability and good service may or may not be available.

Advantages of Private Cloud

1. It improves average server utilization
2. allow usage of low-cost servers and hardware while providing higher efficiencies
3. thus reducing the costs that a greater number of servers would otherwise require.
4. It provides a high level of security and privacy to the user.
5. It is small in size and controlled and maintained by the organization.

one **major limitation** is that IT teams in the organization may have to invest in buying, building and managing the clouds independently. Budget is a constraint in private clouds and they also have loose SLAs.

2. Public Cloud:

These are also called Provider Clouds.

The public cloud is the cloud infrastructure that is provisioned for open use by the general public.

It may be owned, managed, and operated by a business, academic, or government organizations, or some combination of them.

Typically, public clouds are administrated by 3rd parties or vendors over the Internet, and the services are offered on pay-per-use basis.

Public cloud consists of users from all over the world wherein a user can simply purchase resources on an hourly basis and work with the resources which are available in the cloud provider's premises.

Characteristics of Public Cloud are as follows:

Highly Scalable	The resources in the public cloud are large in number and the service providers make sure that all requests are granted. Hence public clouds are considered to be scalable.
Affordable	The cloud is offered to the public on a pay-as-you-go basis. And this does not involve any cost related to the deployment.
Less Secure	Since it is offered by a 3rd party and they have full control over the cloud, the public cloud is less secure out of all the other deployment models.
Highly Available	It is highly available because anybody from any part of the world can access the public cloud with proper permission, and this is not possible in other models as geographical or other access restrictions might be there.
Stringent SLAs	As the service provider's business reputation and customer strength are totally dependent on the cloud services, they follow the SLAs strictly and violations are avoided.

Advantages of Public Cloud

1. It is widely used in the development, deployment and management of enterprise applications, at **affordable** costs.
2.It allows the organizations to deliver **highly scalable** and reliable applications rapidly and at more affordable costs.
3.Strict SLAs are followed.
4.There is no need for establishing infrastructure for setting up and maintaining the cloud.
5.There is no limit for the number of users.

Moreover, **one of the limitations** is security assurance and thereby building trust among the clients is far from desired but slowly liable to happen. Further, privacy and organizational autonomy are not possible.

3.Hybrid Cloud:

This is a combination of both at least 1 private (internal) and at least 1 public (external) cloud computing environments - usually, consisting of infrastructure, platforms and applications.

The usual method of using the hybrid cloud is to have a private cloud initially, and then for additional resources, the public cloud is used. **(1st – private and then public)**

The hybrid cloud can be regarded as a private cloud extended to the public cloud and aims at utilizing the power of the public cloud by retaining the properties of the private cloud.

It is typically offered in either of 2 ways.

A vendor has a private cloud and forms a partnership with a public cloud provider or	a public cloud provider forms a partnership/franchise with a vendor that provides private cloud platforms.

Characteristics of Hybrid Cloud are as follows:

Scalable	The hybrid cloud has the property of public cloud with a private cloud environment and as the public cloud is scalable. the hybrid cloud with the help of its public counterpart is also scalable.
Partially Secure	The private cloud is considered as secured and public cloud has high risk of security breach. The hybrid cloud thus cannot be fully termed as secure but as partially secure.
Stringent SLAs	Overall the SLAs are more stringent than the private cloud and might be as per the public cloud service providers.
Complex Cloud Management	Cloud management is complex as it involves more than one type of deployment models and also the number of users is high.

Advantages of Hybrid Cloud

1.It is highly scalable and gives the power of both private and public clouds.
2.It provides better security than the public cloud.

The **limitation** of Hybrid Cloud is that the security features are not as good as the public cloud and complex to manage.

4. Community Cloud:

The community cloud is the cloud infrastructure that is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (eg. mission security requirements, policy, and compliance considerations).

It may be owned, managed, and operated by one or more of the organizations in the community, a 3rd party or some combination of them, and it may exist on or off premises.

In this, a private cloud is shared between several organizations.

This model is suitable for organizations that cannot afford a private cloud and cannot rely on the public cloud either.

Characteristics of Community Clouds are as follows:

Collaborative and Distributive Maintenance	In this, no single company has full control over the whole cloud. This is usually distributive and hence better cooperation provides better results.
Partially Secure	This refers to the property of the community cloud where few organizations share the cloud, so there is a possibility that the data **can be leaked** from one organization to another, **though** it is **safe** from the external world.

Cost Effective	As the complete cloud is being shared by several organizations or community, not only the responsibility gets shared. the community cloud becomes cost effective too.

Advantages of Community Clouds

1.It **allows** establishing a cost effective private cloud.
2.It **allows** collaborative work on the cloud.
3.It **allows** sharing of responsibilities among the organizations.
4.It has better security than the public cloud.

The **limitation** of the community cloud is that the autonomy of the organization is lost and some of the security features are not as good as the private cloud. It is not suitable in the cases where there is no collaboration.

Cloud Computing Service Models

Infrastructure as a Service (IaaS)	Platform as a Service (PaaS)	Software as a Service (SaaS)	Other Cloud Service Models
different instances of IaaS -NaaS -STaaS -DBaaS -BaaS -DtaaS		different instances of SaaS -EaaS -APIaaS -Taas	-IDaaS -CaaS -DaaS -SECaaS

The National Institute of Standards and Technology (NIST) defines three basic service models - Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).

Service Model-1. Infrastructure as a Service (IaaS):

IaaS, a hardware-level service, provides computing resources such as processing power, memory, storage, and networks for cloud users to run their application on-demand.

This allows users to maximize the utilization of computing capacities without having to own and manage their own resources.

IaaS changes the computing from a physical infrastructure to a virtual infrastructure through virtual computing; storage; and network resources by abstracting the physical resources.

The end-users or IT architects will use the infrastructure resources in the form of Virtual machines (VMs) and design virtual infrastructure, network load balancers etc., based on their needs.

The IT architects need not maintain the physical servers as it is maintained by the service providers.

Examples of IaaS providers include Amazon Web Services (AWS), Google Compute Engine, OpenStack and Eucalyptus.

A typical IaaS provider may provide the following services (CSNL)

Compute	Computing as a Service includes virtual CPUs and virtual main memory for the Virtual Machines (VMs) that are provisioned to the end users.
Storage	STaaS provides back-end storage for the VM images. Some of the IaaS providers also provide the back end for storing files.
Network	Network as a Service (NaaS) provides virtual networking components such as virtual router, switch, and bridge for the VMs.

Load Balancers	Load balancing as a Service may provide load balancing capability at the infrastructure layer.

Characteristics of IaaS are as follows – WCM-ES

Web access to the resources	The IaaS model enables the IT users to access infrastructure resources over the Internet. When accessing a huge computing power, the IT user need not get physical access to the servers.
Centralized management	The resources distributed across different parts are controlled from any management console that ensures effective resource management and effective resource utilization.
Metered Services	IaaS allows the IT users to rent the computing resources instead of buying it. The services consumed by the IT user will be measured, and the users will be charged by the IaaS providers based on the amount of usage.
Elasticity and Dynamic Scaling	Depending on the load, IaaS services can provide the resources and elastic services where the usage of resources can be increased or decreased according to the requirements.
Shared infrastructure	IaaS follows a one-to-many delivery model and allows multiple IT users to share the same physical infrastructure and thus ensure high resource utilization.

Different instances of IaaS

Network as a Service (NaaS)

NaaS, provides users with needed data communication capacity to accommodate cracks in data traffic during data-intensive activities such as video conferencing or large file downloads.

It is an ability given to the end-users to access virtual network services that are provided by the service provider over the Internet on pay-per-use basis.

NaaS allows **network architects** to create virtual networks.

virtual network interface cards (NICs),
virtual routers,
virtual switches, and

other networking components.

It further allows the **network architect** to deploy custom routing protocols and enables the design of efficient in-network services, such as data aggregation, stream processing, and caching.

NaaS providers operate using 3 common service models:

Virtual Private Network (VPN),
Bandwidth on Demand (BoD) and
Mobile Virtual Network (MVN).

Storage as a Service (STaaS):

STaaS, an instance of IaaS, provides storage infrastructure on a subscription basis to users who want a

low-cost and convenient way to store data,
synchronize data across multiple devices,
manage off-site backups,
mitigate risks of disaster recovery, and
preserve records for the long-term.

It is an ability given to the end users to store the data on the storage services provided by the service provider.

STaaS allows the end users to access the files at any time from any place.

STaaS provider provides the virtual storage that is abstracted from the physical storage of any cloud data center.

STaaS is also a cloud business model that is delivered as a utility.

Database as a Service (DBaaS):

This is also related to IaaS and provides users with seamless mechanisms to create, store, and access databases at a host site on demand.

It is an ability given to the end users to access the database service without the need to install and maintain it on the pay-per-use basis.

The end users can access the database services through any Application Programming Interfaces (APIs) or Web User Interfaces(WBIs) provided by the service provider.

Backend as a Service (BaaS):

It is a type of IaaS, that provides web and mobile app developers a way to connect their applications to backend cloud storage with added services such as user management, push notifications, social network services integration using custom software development kits and application programming interfaces.

Desktop as a Service (DTaaS):

It is an instance of IaaS that provides ability to the end users to use desktop virtualization without buying and managing their own infrastructure.

DTaaS is a pay-per-use cloud service delivery model in which the service provider manages the back-end responsibilities of data storage, backup, security and upgrades.

The end-users are responsible for securing and managing their own desktop images, applications, and security.

These services are simple to deploy, are highly secure, and produce better experience on almost all devices.

Service Model-2: Platform as a Service (PaaS)

PaaS provides the users the ability to develop and deploy an application on the development platform provided by the service provider.

In traditional application development, the application will be developed locally and will be hosted in the central location.

In stand-alone application development, the application will be developed by traditional development platforms result in licensing - based software, whereas PaaS changes the application development from local machine to online.

For example- Google AppEngine, Windows Azure Compute etc.

Typical PaaS providers may provide - PADO

Programming Languages	PaaS providers provide a wide variety of programming languages like Java, PHP, Python, Ruby etc. for the developers to develop applications.

Application Frameworks	PaaS vendors provide application development framework like Joomla, WordPress, Sinatra etc. for application development.
Database	Along with PaaS platforms, PaaS providers provide some of the popular databases like ClearDB, Cloudant, Redis etc. so that application can communicate with the databases.
Other Tools	PaaS providers provide all the tools that are required to develop, test, and deploy an application.

Characteristics of PaaS are as follows: - ABCDWO

All in One	Most of the PaaS providers offer services like programming languages to develop, test, deploy, host and maintain applications in the same Integrated Development Environment (IDE).
Built-in Scalability	PaaS services provide built-in scalability to an application that is developed using any particular PaaS. This ensures that the application is capable of handling varying loads efficiently.
Collaborative Platform	To enable collaboration among developers, most of the PaaS providers provide tools for project planning and communication.
Diverse Client Tools	PaaS providers offer a wide variety of client tools like Web User Interface (UI), Application Programming Interface (API) etc. to help the developers to choose the tool of their choice.
Web access to the development platform	PaaS provides web access to the development platform that helps the developers to create, modify, test, and deploy different applications on the same platform.
Offline Access	To enable offline development, some of the PaaS providers allow the developer to synchronize their local IDE with the PaaS services. The developers can develop an application locally and deploy it online whenever they are connected to the Internet.

Service Model-3: Software as a Service (SaaS)

SaaS provides ability to the end users to access an application over the Internet that is hosted and managed by the service provider.

Thus, the end users are exempted from managing or controlling an application the development platform, and the underlying infrastructure.

SaaS changes the way the software is delivered to the customers.

In the traditional software model, the software is delivered as a license-based product that needs to be installed in the end user device.

Since SaaS is delivered as an on-demand service over the Internet, there is no need to install the software to the end-user's devices.

SaaS services can be accessed or disconnected at any time based on the end user's needs.

The services provided by SaaS are:

Business Services	SaaS providers provide a variety of business services to startup companies that includes ERP, CRM, billing, sales, and human resources.
Social Networks	Since the number of users of the social networking sites is increasing exponentially, loud computing is the perfect match for handling the variable load.
Document Management	Most of the SaaS providers provide services to create, manage, and track electronic documents as most of the enterprises extensively use electronic documents.
Mail Services	To handle the unpredictable number of users and the load on e- mail services, most of the email providers offer their services as SaaS services.

Characteristics of SaaS are as follows: A-COW-HM-B

API Integration	SaaS services have the capability of integrating with other software or service through standard APIs.
Centralized Management	Since SaaS services are hosted and managed from the central location, the SaaS providers perform the automatic updates to ensure that each customer is accessing the most recent version of the application without any user-side updates.
One to Many	SaaS services are delivered as one-to-many models where a single instance of the application can be shared by multiple customers.
Web Access	SaaS services allow the end users to access the application from any location of the device is connected to the Internet.
High Availability	SaaS services ensure 99.99% availability of user data as proper backup and recovery mechanisms are implemented.
Multi-device Support	SaaS services can be accessed from any end user devices such as desktops, laptops, tablets, smartphones, and thin clients.
Better Scalability	Most of the SaaS services leverage PaaS and IaaS for its development and deployment and ensure a better scalability than traditional software.

Different instances of SaaS

Email as a Service (EaaS)

This provides users with an integrated system of emailing, office automation, records management, migration, and integration services with archiving, spam blocking, malware protection, and compliance features.

API as a Service (APIaaS)

This allows users to explore functionality of Web services such as Google Maps, Payroll processing, and credit card processing services etc.

Testing as a Service (TaaS)

This provides users with software testing capabilities such as generation of test data, generation of test cases, execution of test cases and test result evaluation on a pay-per-use basis.

Other Cloud Service Models

Identity as a Service (IDaaS)

It is an ability given to the end users; typically, an organization or enterprise; to access the authentication infrastructure that is built, hosted, managed and provided by the third party service provider.

Generally, IDaaS includes directory services, authentication services, risk and event monitoring, single sign-on services, and identity and profile management.

Communication as a Service (CaaS)

CaaS has evolved in the same lines as SaaS.

CaaS is an outsourced enterprise communication solution that can be leased from a single vender.

The CaaS vendor is responsible for all hardware and software management and offers guaranteed Quality of Service (QoS).

It allows businesses to selectively deploy communication devices and modes on a pay-as-you-go, as- needed basis.

This approach eliminates the large capital investments.

Examples are: Voice over IP (VolP), Instant Messaging (IM), Collaboration and Videoconferencing application using fixed and mobile devices.

Data as a Service (DaaS)

DaaS provides data on demand to a diverse set of users, systems or application.

The data may include text, images, sounds, and videos.

Data encryption and operating system authentication are commonly provided for security.

DaaS users have access to high-quality data in a centralized place and pay by volume or data type, as needed.

However, as the data is owned by the providers, users can only perform read operations on the data.

DaaS is highly used in geography data services and financial data services.

Security as a Service (SECaaS)

It is an ability given to the end user to access the security service provided by the service provider on a pay-per-use basis.

It is a new approach to security in which cloud security is moved into the cloud itself whereby cloud service users will be protected from within the cloud using a unified approach to threats.

Four mechanisms of Cloud security that are currently provided are

Email filtering,
Web content filtering,
Vulnerability management and
Identity management.

Characteristics of Cloud Computing (H-MPV, H-MAS)

High Scalability	Cloud environments enable servicing of business requirements for larger audiences, through high scalability.
Multi-sharing	With the cloud working in a distributed and shared mode, multiple users and applications can work more efficiently with cost reductions by sharing common infrastructure.
Performance	It is monitored and consistent and loosely coupled architectures are constructed using web services as the system interface.
Virtualization	This technology allows servers and storage devices to increasingly share and utilize applications, by easy migration from one physical server to another.
High Availability and Reliability	Availability of servers is supposed to be high and more reliable as the chances of infrastructure failure are minimal.
Maintenance	The cloud computing applications are easier, because they are not to be installed on each user's computer and can be accessed from different places.
Agility	The cloud works in the 'distributed mode 'environment. It shares resources among users and tasks, while improving efficiency and agility.
Services in Pay-Per-Use Mode	SLAs between the provider and the user must be defined when offering services in pay per use mode. This may be based on the complexity of services offered. Application Programming Interfaces (APIs) may be offered to the users so they can access services on the cloud by using these APIs.

Advantages of Cloud Computing (A-CAB-EQ)

Almost Unlimited Storage	Storing information in the cloud gives us almost unlimited storage capacity. Hence, one no more need to worry about running out of storage space or increasing the current storage space availability.
Cost Efficiency	Cloud computing is probably the most cost efficient method to use, maintain and upgrade. It is available at much cheaper rates and hence, can significantly lower the company's IT expenses. Besides, there are many one-time-payments, pay-as-you-go and other scalable options available, which make it very reasonable for the company.
Automatic Software Integration	In the cloud, software integration is usually something that occurs automatically. This means that we do not need to take additional efforts to customize and integrate the applications as per our preferences. This aspect usually takes care of itself. Not only that, cloud computing allows us to customize the options with great ease.
Backup and Recovery	Since all the data is stored in the cloud, backing it up and restoring the same is relatively much easier than storing the same on a physical device. Furthermore, most cloud service providers are usually competent enough to handle recovery of information. Hence, this makes the entire process of backup and recovery much simpler than other traditional methods of data storage.
Easy Access to Information	Once registered in the cloud, one can access the information from anywhere, where there is an Internet connection. This convenient feature lets one move beyond time zone and geographic location issues.
Quick Deployment	Lastly and most importantly, cloud computing gives us the advantage of quick deployment. Once we opt, the entire system can be fully functional in a matter of a few minutes.

Mobile Computing

Mobile Computing refers to the technology that allows transmission of data via a computer without having to be connected to a fixed physical link.

Mobile voice communication is widely established throughout the world and has had a very rapid increase in the number of subscribers to the various cellular networks over the last few years.

Components of Mobile Computing: (M^3)

1. Mobile Communication

This refers to the infrastructure put in place to ensure that seamless and reliable communication goes on. This would include communication properties, protocols, data formats and concrete technologies.

2. Mobile Hardware

This includes mobile devices or device components that receive or access the service of mobility.

They would range from Portable laptops, Smart Phones, Tablet PCs, and Personal Digital Assistants (PDA) that use an existing and established network to operate on.

At the back end, there are various servers like Application Servers, Database Servers and Servers with wireless support, WAP gateway, a Communications Server and/or MCSS (Mobile Communications Server Switch) or a wireless gateway embedded in wireless carrier's network (this server provide communications functionality to allow the handheld device to communicate with the internet or Intranet Infrastructure).

The characteristics of mobile computing hardware are defined by the size and form factor, weight, microprocessor, primary storage, secondary storage, screen size and type, means of input, means of output, battery life, communications capabilities, expandability and durability of the device.

3. Mobile Software

Mobile Software is the actual programme that runs on the mobile hardware and deals with the characteristics and requirements of mobile applications.

It is the operating system of that appliance and is the essential component that makes the mobile device operates.

Mobile applications popularly called Apps are being developed by organizations for use by customers but these apps could represent risks, in terms of flow of data as well as personal identification risks, introduction of malware and access to personal information of mobile owner.

Limitations of Mobile Computing (HP-TIPS)

Human interface with device	Screens and keyboards tend to be small, which may make them hard to use. Alternate input methods such as speech or handwriting recognition require training.
Potential health hazards	People who use mobile devices while driving are often distracted from driving are thus assumed to be more likely involved in traffic accidents. Cell phones may interfere with sensitive medical devices. There are allegations that cell phone signals may cause health problems.
Transmission interferences	Weather, terrain, and the range from the nearest signal point can all interfere with signal reception. Reception in tunnels, some buildings, and rural areas is often poor.
Insufficient Bandwidth	Mobile Internet access is generally slower than direct cable connections using technologies such as General Packet Radio Service (GPRS) and Enhanced Data for GSM (Global System for Mobile Communication) Evolution (EDGE), and more recently 3G networks. These networks are usually available within range of commercial cell phone towers. Higher speed wireless LANs are inexpensive but have very limited range.
Power consumption	When a power outlet or portable generator is not available, mobile computers must rely entirely on battery power. Combined with the compact size of many mobile devices, this often means unusually expensive batteries must be used to obtain the necessary battery life. Mobile computing should also look into Greener IT in such a way that it saves the power or increases the battery life.
Security Standards	When working mobile, one is dependent on public networks, requiring careful use of Virtual Private Network (VPN). Security is a major concern while concerning the mobile computing standards. One can easily attack the VPN through a huge number of networks interconnected through the line.

Issues in Mobile Computing – (RBI-SLR-BEP)

Reliability, coverage, capacity, and cost

At present; wireless network is less reliable, have less geographic coverage and reduced bandwidth, are slower, and cost more than the wired-line network services.

It is important to find ways to use this new resource more efficiently by designing innovative applications.

Business challenges:

In addition to these technical challenges, mobile computing also faces business challenges.

This is due to the lack of trained professionals to bring the mobile technology to the general people and development of pilot projects for testing its capabilities.

Integration with legacy mainframe and emerging client/server applications:

Application development paradigms are changing.

As a result of the IT industry's original focus on mainframes, a huge inventory of applications using communications interfaces that are basically incompatible with mobile connectivity have been accumulated. Still the application development trend is geared towards wired network.

Security Issues: - ALI-CA

Wireless networks have relatively more security requirements than wired network. A number of approaches have been suggested and also the use of encryption has been proposed.

Availability: Ensuring authorized users getting the access they require.

Legitimate: Ensuring that only authorized users have access to services.

Integrity: Ensures unauthorized modification, destruction or creation of information cannot take place.

Confidentiality: Preventing unauthorized users from gaining access to critical information of any particular user.

Accountability: Ensuring that the users are held responsible for their security related activities by arranging the user and his/her activities are linked if and when necessary.

Location Intelligence

A mobile computer must be able to switch from infrared mode to radio mode as it moves from indoors to outdoors.

Additionally, it should be capable of switching from cellular mode of operation to satellite mode as the computer moves from urban and rural areas.

In mobile computing; as computers are working in cells and are being serviced by different network providers, the physical distance may not reflect the true network distance.

A small movement may result in a much longer path if cell or network boundaries are crossed.

It will also lead to updating of the location dependent information as described above.

This can increase the network latency as well as risk of disconnection.

Service connections must be dynamically transferred to the nearest server.

Revising the technical architecture

Mobile users are demanding and are important to the business world.

To provide complete connectivity among users; the current communication technology must be revised to incorporate mobile connectivity.

Additionally, application and data architectures must also be revised to support the demands put upon them by the mobile connectivity.

Bandwidth

Bandwidth utilization can be improved by logging (bulk operations against short requests) and compression of data before transmission.

The technique of caching frequently accessed data items can play an important role in reducing contention in narrow bandwidth wireless networks.

The cached data can help improve query response time.

Since mobile clients often disconnect to conserve battery power the cached data can support disconnected operations.

End-to-end design and performance

Since mobile computing involves multiple networks (including wired) and multiple application server platforms; end-to-end technical compatibility, server capacity design, and network response time estimates are difficult to achieve.

Power Consumption

Mobile Computers will rely on their batteries as the primary power source.

Batteries should be ideally as light as possible but at the same time they should be capable of longer operation times.

Power consumption should be minimized to increase battery life.

Chips can be redesigned to operate at lower voltages.

Power management can also help Individual Components, be powered down when they are idle.

Green Computing

Green computing or Green IT refers to the study and practice of environmentally sustainable computing or IT.

Computers consume a lot of natural resources, from the raw materials needed to manufacture them, the power used to run them, and the problems of disposing them at the end of their life cycle.

This can include "designing, manufacturing, using, and disposing of computers, servers, and associated subsystems - such as monitors, printers, storage devices, and networking and communications systems - efficiently and effectively with minimal or no impact on the environment".

The objective of Green computing is to reduce the use of hazardous materials, maximize energy efficiency during the product's lifetime, and promote the recyclability or biodegradability of defunct products and factory waste.

Such practices include the implementation of energy-efficient Central Processing Units (CPUs), servers and peripherals as well as reduced resource consumption and proper disposal of electronic waste (e-waste).

Green Computing Best Practices-(MR.CRD)

Some of such steps for Green IT include the following:

Make environmentally sound purchase decisions	-Purchase of desktop computers, notebooks and monitors based on environmental attributes. -Provide a clear, consistent set of performance criteria for the design of products. -Recognize manufacturer efforts to reduce the environmental impact of products by reducing or eliminating environmentally sensitive materials, designing for longevity and reducing packaging materials. -Use Server and storage virtualization that can help to improve resource utilization, reduce energy costs and simplify maintenance.
Reduce Paper Consumption	-Reduce paper consumption by use of e-mail and electronic archiving

	-Use of "track changes" feature in electronic documents, rather than redline corrections on paper; -Use online marketing rather than paper based marketing. -While printing documents, make sure to use both sides of the paper, recycle regularly, use smaller fonts and margins.
Conserve Energy	-Use LCD monitors rather than CRT monitors. -Develop a thin-client strategy wherein thin clients are smaller, cheaper, simpler for manufacturers to build than traditional PCs or notebooks and most importantly use about half the power of a traditional desktop PC. -Use notebook computers rather than desktop computers. -Power-down the CPU and all peripherals during extended periods of inactivity -Adapt more of Web conferencing offers instead of travelling to meetings in order to go green and save energy. -Use the power-management features to turn off hard drives and displays after several minutes of inactivity.
Recycle	-Dispose e-waste according to central, state and local regulations. -Discard used or unwanted electronic equipment in a convenient and environmentally responsible manner as computers emit harmful emissions. -Manufacturers must offer safe end-of-life management and recycling options when products become unusable. -Recycle computers through manufacturer's recycling services.
Develop a sustainable Green Computing plan	-Involve stakeholders to include checklists, recycling policies, recommendations for disposal of used equipment, government guidelines and recommendations for purchasing green computer equipment in organizational policies and plans. -Encourage the IT community for using the best practices and encourage them to consider green computing practices and guidelines. -Use cloud computing so that multiple organizations share the same computing resources, thus increasing the utilization by making more efficient use of hardware resources.

Bring Your Own Device (BYOD)

Advantages of BYOD – (HI-LIE)

Happy Employees	Employees love to use their own devices when at work. This also reduces the number of devices an employee has to carry; otherwise he would be carrying his personal as well as organization provided devices.
IT reduces support requirement	IT department does not have to provide end user support and maintenance for all these devices resulting in cost savings.
Lower IT budgets	The employees could involve financial savings to the organization since employees would be using the devices they already possess, thus reducing the outlay of the organization in providing devices to them.
Increased employee efficiency	The efficiency of employees is more when the employee works on his/her own device. In an organization provided devices, employees have to learn and there is a learning curve involved in it.
Early adoption of new Technologies	Employees are generally proactive in adoption of new technologies that result in enhanced productivity of employees leading to overall growth of business.

Types and Behavior of Social Networks

the main categories identified are given below:

Social Contact Networks	These types of networks are formed to keep contact with friends and family. These have become the most popular sites on the network today. They have all components of Web 2.0 like blogging, tagging, wikis, and forums. **Examples** of these include Orkut, Facebook and Twitter.
Study Circles	These are social networks dedicated for students, where they can have areas dedicated to student study topics, placement related queries and advanced research opportunity gathering. These have components like blogging and file sharing. **Examples** of these include, Fledge Wing and College Tonight.
Social Networks for Specialist Groups	These types of social networks are specifically designed for core field workers like doctors, scientists, engineers, members of the corporate industries. **Example** for this type of network is LinkedIn.
Sporting Networks	These types of social networks are dedicated to people of the sporting fraternity and have a gamut of information related to this field. **Examples** of these include Athlinks.
Social Networks for the 'inventors'	These are the social networks for the people who have invented the concept of social networks, the very developers and architects that have developed the social networks. **Examples** include Technical Forums and Mash-up centres.
Shopping and Utility Service Networks	The present world of huge consumerism has triggered people to invest in social networks, which will try to analyze the social behavior and send related information for the same to respective marts and stores.
Networks for Fine Arts	These types of social networks are dedicated to people linked with music, painting and related arts and have lots of useful networking information for all aspiring people of the same line.
Police and Military Networks	These types of networks, though not on a public domain, operate much like social networks on a private domain due to the confidentiality of information.
Mixed Networks	There are a number of social networks that have a subscription of people from all the above groups and is a heterogeneous social network serving multiple types of social collaboration.
Others	Apart from the networks outlined above, there are multiple other social networks, which serve huge number of the internet population in multiple ways. Some of these networks die out very fast due to lack of constructive sustenance thoughts while others finally migrate to a more specialist network

Life Cycle of Social Networks

The concept of social networks and the components of Web 2.0, which are significant for social networks have been outlined above.

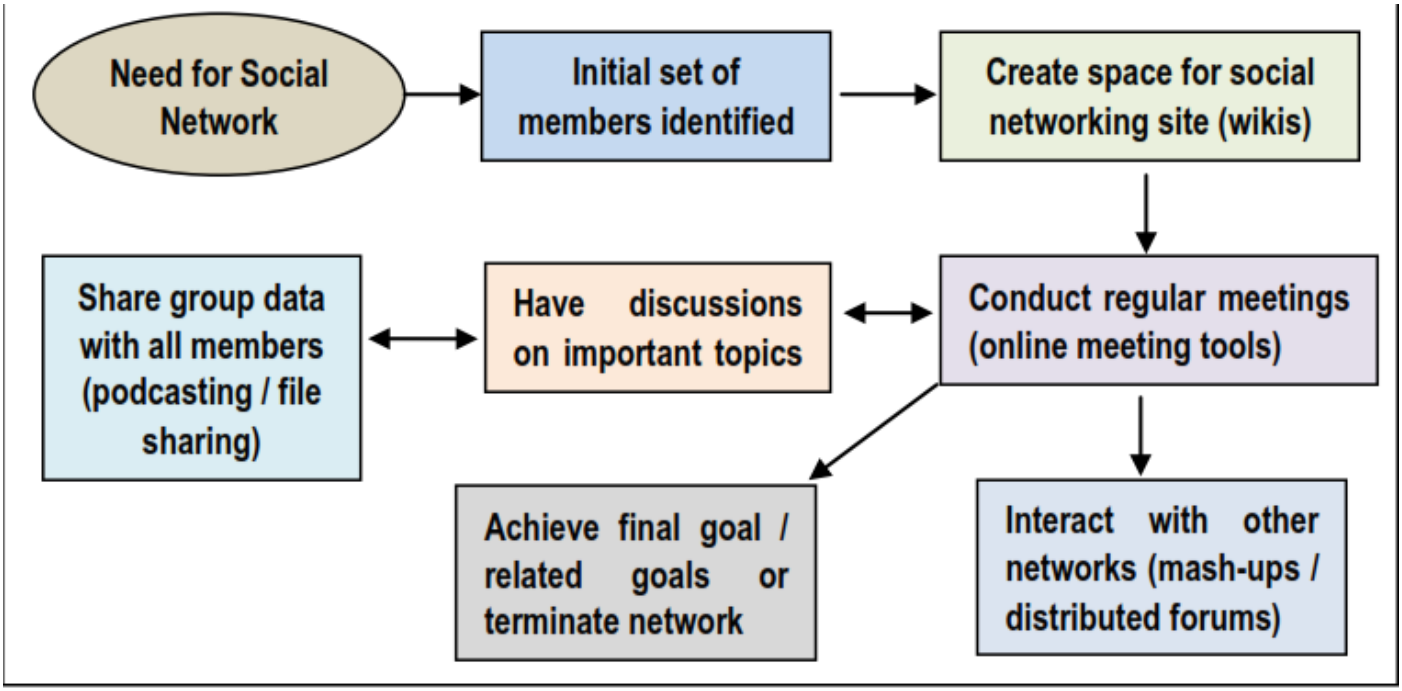
For any social network, there are a number of steps in its life cycle. In each of the life cycle step of an online social network, Web 2.0 concepts have a great influence.

For all the steps in the life cycle, Web 2.0 provides tools and concepts, which are not only cost effective but very easy to implement.

Often, online networks have a tendency to die out very fast due to lack of proper tools to communicate.

Web 2.0 provides excellent communication mechanism concepts like Blogging and individual email filtering to keep everyone in the network involved in the day to day activities of the network.

Picture shows - Life Cycle of Social Networks with Web 2.0



Applications of Web 2.0 –(SEM)

1. Social Media

Social Media/Social Network is an important application of web 2.0 as it provides a fundamental shift in the way people communicate and share information.

The social web offers a number of online tools and platforms that could be used by the users to share their data, perspectives, and opinions among other user communities.

2. Education

Web 2.0 technologies can help the education scenario by providing students and faculty with more opportunities to interact and collaborate with their peers.

By utilizing the tools of Web 2.0, the students get the opportunity to share what they learn with other peers by collaborating with them.

3. Marketing

Web 2.0 offers excellent opportunities for marketing by engaging customers in various stages of the product development cycle.

It allows the marketers to collaborate with consumers on various aspects such as product development, service enhancement, and promotion.

Collaboration with the business partners and consumers can be improved by the companies by utilizing the tools provided by Web 2.0 paradigm.

Consumer-oriented companies use networks such as Twitter and Facebook as common elements of multichannel promotion of their products.

Web 3.0

The term Web 3.0, also known as the Semantic Web, describes sites wherein the computers will be generated raw data on their own without direct user interaction.

Web 3.0 is considered as the next logical step in the evolution of the Internet and Web technologies.

For Web 1.0 and Web 2.0; the Internet is confined within the physical walls of the computer, but as more and more devices such as smartphones, cars and other household appliances become connected to the web, the Internet will be widespread and could be utilized in the most efficient manner.

Web 2.0 technologies allows the use of read/write web, blogs, interactive web applications, rich media, tagging or folksonomy while sharing content, and also social networking sites focusing on communities.

At the same time, Web 3.0 standard uses
semantic web technology,
drag and drop mash-ups,
widgets, user behavior,
user engagement, and

consolidation of dynamic web contents depending on the interest of the individual users.

Web 3.0 technology uses the **"Data Web"** Technology, which features the data records that are publishable and reusable on the web through query- able formats. T

he Web 3.0 standard also incorporates the latest researches in the field of artificial intelligence.

An example of typical Web 3.0 application is the one that uses content management systems along with artificial intelligence.

These systems are capable of answering the questions posed by the users, because the application is able to think on its own and find the most probable answer, depending on the context, to the query submitted by the user.

In this way, Web 3.0 can also be described as a "machine to user" standard in the internet.

The two major components of Web 3.0 are as follows:

Semantic Web	Web Services
This provides the web user a common framework that could be used to share and reuse the data across various applications, enterprises, and community boundaries. This allows the data and information to be readily intercepted by machines, so that the machines are able to take contextual decisions on their own by finding, combining and acting upon relevant information on the web.	It is a software system that supports computer-to-computer interaction over the Internet. **For example -** the popular photo-sharing website Flickr provides a web service that could be utilized and the developers to programmatically interface with Flickr in order to search for images.