

CHAPTER 8

EMERGING TECHNOLOGIES

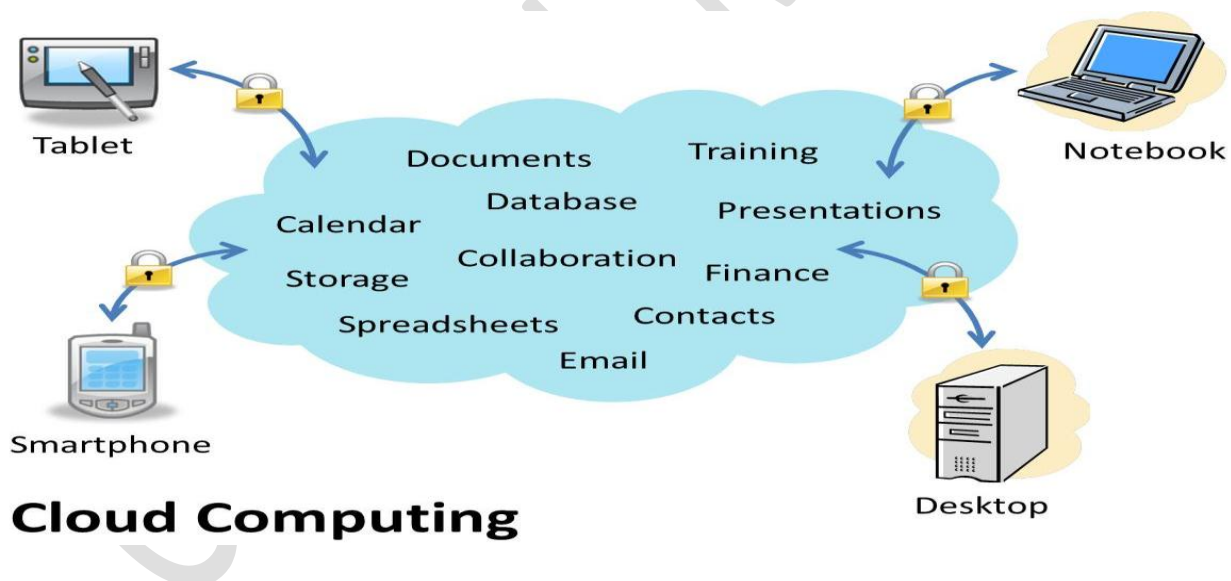
1. INTRODUCTION:

Emerging Technologies are contemporary advances and innovation in various fields of technology. Various *converging technologies* have emerged in the technological convergence of different systems evolving towards similar goals. Emerging technologies are those technical innovations which represent progressive developments within a field for competitive advantage.

Emerging technologies in general denote significant technology developments. Examples of such currently emerging technologies are: synthetic biology, Nano-scale design, systems biology, wireless networks, ICT-enhanced educational systems etc. Some of the technologies, which have recently emerged and are being rapidly adapted include **CLOUD, GRID MOBILE, AND GREEN COMPUTING**. The details are as under for each emerging technology:

2. CLOUD COMPUTING:

Cloud computing is a combination of software and computing delivered as a networked service that provides a model for enabling anytime access to a shared pool of applications and resources. These applications and resources can be accessed using a simple front-end interface such as a Web browser, and as a result enables users to access the resources from any client device including notebooks, desktops and mobile devices.



Cloud computing provides the facility to **access shared resources and common infrastructure** offering services on demand over the network to perform operations that meet challenging and changing business needs.

Cloud Computing is a technology that uses the internet and central remote servers to maintain data and applications. Cloud computing allows consumers and businesses to use applications without installation and access their personal files at any computer with internet access. This technology allows for much more efficient computing by centralizing data storage, processing and bandwidth. A simple example of cloud computing is Yahoo email, Gmail, or Hotmail etc. All you need is just an

internet connection and you can start sending emails. The server and email management software is all on the cloud (internet) and is totally managed by the cloud service provider Yahoo, Google etc.

Benefits of cloud computing for the business:

1. Efficient storage and computing services
2. Inexpensive, since all the virtual resources whether application, hardware or data are covered by the service provider.
3. Allow for easy connectivity to servers and information sharing.
4. Assures appropriate use of resources as the users are required to pay only for the services they require.
5. Highly reliable and redundant.
6. Widespread availability irrespective of geographical precincts.



3. GRID COMPUTING:

Grid computing is used to make use of such non-utilised computing power by the needy organisation. These computing resources are those resources which are under-utilised by the organisation.

Grid Computing:

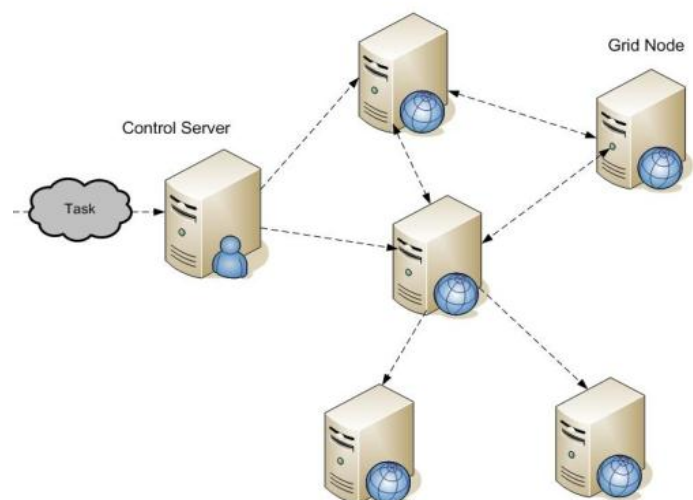
“It is network of computing or processor machines managed with a kind of software in order to access and use the resources remotely.”

Grid computing assumed popularity due to following reasons:

- (a) Through grid computing, entity can make use of unused computer resources.
- (b) This enables resources of computers to work cooperatively.

CLOUD Vs GRID COMPUTING:

Interconnected computer systems where the machines utilize the same resources collectively. Grid usually consists of one main computer that distributes information and tasks to a group of networked computers to accomplish a goal. Grid computing is often used to complete complicated or tedious mathematical or scientific calculations.



hat can divide the program in to pieces as one large system image into several thousand computers.

SIMILARITIES & DIFFERENCES IN CLOUD AND GRID COMPUTING

Cloud computing and grid computing are scalable. Scalability is accomplished through load balancing of application instances running separately on a variety of operating systems and connected through Web services. CPU and network bandwidth is allocated and de-allocated on demand. The system's storage capacity goes up and down depending on the number of users, instances, and the amount of data transferred at a given time.

CLOUD COMPUTING	GRID COMPUTING
Cloud computing works more as a service provider for utilizing computer resource	Grid computing uses the available resource and interconnected computer systems to accomplish a common goal
Cloud computing is a centralized model	Grid computing is a decentralized model, where the computation could occur over many administrative model
Cloud is a collection of computers usually owned by a single party.	A grid is a collection of computers which is owned by a multiple parties in multiple locations and connected together so that users can share the combined power of resources
Cloud offers more services all most all the services like web hosting, DB (Data Base) support and much more	Grid provides limited services
Cloud computing is typically provided within a single organization (eg : Amazon)	Grid computing federates the resources located within different organization.

PERTINENT ISSUES

There are various Issues to consider while talking about the cloud computing. Four issues stand out with cloud and grid computing: threshold policy, interoperability issues, hidden costs, and unexpected behaviour.

Threshold policy

Let's suppose I had a program that did credit card validation in the cloud, and we hit the crunch for the December buying season. Higher demand would be detected and more instances would be created to fill that demand. As we moved out of the buying crunch, the need would be diminished and the instances of that resource would be de-allocated and put to other use.

To test if the program works, develop, or improve and implement, a threshold policy in a pilot study before moving the program to the production environment. Check how the policy detects sudden increases in the demand and results in the creation of additional instances to fill in the demand. Also check to determine how unused resources are to be de-allocated and turned over to other work.

Interoperability issues

If a company outsources or creates applications with one cloud computing vendor, the company may find it is difficult to change to another computing vendor that has proprietary APIs and different formats for importing and exporting data. This creates problems of achieving interoperability of applications between these two cloud computing vendors. You may need to reformat data or change the logic in applications. Although industry cloud-computing standards do not exist for APIs or data import and export, IBM and Amazon Web Services have worked together to make interoperability happen.

Hidden costs

Cloud computing does not tell you what hidden costs are. For instance, companies could incur higher network charges from their service providers for storage and database applications containing terabytes of data in the cloud. This outweighs costs they could save on new infrastructure, training new personnel, or licensing new software.

Unexpected behavior

Let's suppose your credit card validation application works well at your company's internal data center. It is important to test the application in the cloud with a pilot study to check for unexpected behavior. Examples of tests include how the application validates credit cards, and how, in the scenario of the December buying crunch, it allocates resources and releases unused resources, turning them over to other work. If the tests show unexpected results of credit card validation or releasing unused resources, you will need to fix the problem before running the application in the cloud.

Security issues

In February 2008, Amazon's S3 and EC2 suffered a three-hour outage. Even though an SLA provides data recovery and service credits for this type of outage, consumers missed sales opportunities and executives were cut off from critical business information they needed during the outage.

Instead of waiting for an outage to occur, consumers should do security testing on their own—checking how well a vendor can recover data. The test is very simple. No tools are needed. All you have to do is to ask for old data you have stored and check how long it takes for the vendor to recover. If it takes too long to recover, ask the vendor why and how much service credit you would get in different scenarios. Verify if the checksums match the original data.

An area of security testing you should do is to test a trusted algorithm to encrypt the data on your local computer, and then try to access data on a remote server in the cloud using the decryption keys. If you can't read the data once you have accessed it, the decryption keys are corrupted, or the vendor is using its own encryption algorithm. You may need to address the algorithm with the vendor.

Another issue is the potential for problems with data in the cloud. To protect the data, you may want to manage your own private keys. Check with the vendor on the private key management. Amazon will give you the certificate if you sign up for it.

Software development in cloud

To develop software using high-end databases, the most likely choice is to use cloud server pools at the internal data corporate centre and extend resources temporarily with Amazon Web services for testing purposes. This allows project managers to better control costs, manage security, and allocate resources to clouds a project is assigned to. The project managers could also assign individual hardware resources to different cloud types: Web development cloud, testing cloud, and production cloud. The cost associated with each cloud type may differ from one another. The cost per hour or usage with the development cloud is most likely lower than the production cloud, as additional features, such as SLA and security, are allocated to the production cloud.

The managers can limit projects to certain clouds. For instance, services from portions of the production cloud can be used for the production configuration. Services from the development cloud can be used for development purpose only. To optimize assets at varying stages of the project of software development, the managers can get cost-accounting data by tracking usage by project and user. If the costs are found to be high, managers can use Amazon EC2 to temporarily extend resources at a very low cost provided that security and data recovery issues have been resolved.

Environmentally friendly cloud computing

One incentive for cloud computing is that it may be more environmentally friendly. First, reducing the number of hardware components needed to run applications on the company's internal data center and replacing them with cloud computing systems reduces energy for running and cooling hardware. By consolidating these systems in remote centers, they can be handled more efficiently as a group.

Second, techniques for cloud computing promote telecommuting techniques, such as remote printing and file transfers, potentially reducing the need for office space, buying new furniture, disposing of old furniture, having your office cleaned with chemicals and trash disposed, and so on. They also reduce the need for driving to work and the resulting carbon dioxide emissions.

GOALS OF CLOUD COMPUTING

Core goal of cloud computing is to pool available resources together into a highly efficient infrastructure. Also infrastructure can be quickly and easily scaled as an organisation's business requirement.

CODE TO REMEMBER: C.A.R.E.S.

1. Consolidation of infrastructure:

To consolidate IT infrastructure into more integrated and manageable environment.

2. Access easibility:

To access services and data from anywhere at any time. It enables or improves “**Anywhere Access (AA)**” for ever increasing users.

3. Reduction of costs:

To reduce costs reacted to IT energy /power consumption.

4. Ecosystem:

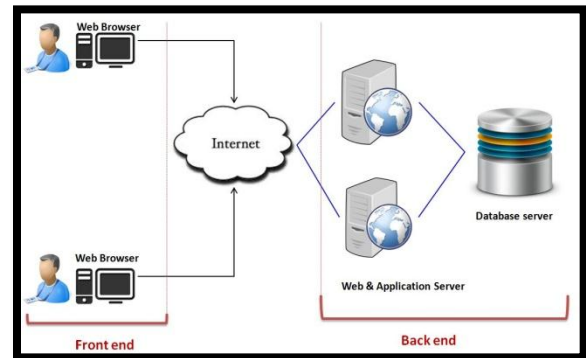
To create highly efficient IT ecosystem, where resources are pooled together and costs are aligned with what resources are actually used.

5. Scaling as per business needs:

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

CLOUD COMPUTING ARCHITECTURE

Cloud computing architecture refers to the components and subcomponents required for cloud computing. These components typically consist of a **front end platform** (fat client, thin client, mobile device), **back end platforms** (servers, storage), a **cloud based delivery**, and a **network** (Internet, Intranet, Intercloud). Combined, these components make up cloud computing architecture.



Now detailed discussion of both:

Front End Architecture: Cloud computing architectures consist of front-end platforms called clients or cloud clients and some applications needed for accessing. These clients comprise servers, fat (or thick) clients, thin clients, zero clients, tablets and mobile devices. These client platforms interact with the cloud data storage via an application (middleware), via a web browser, 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: it 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. It includes any type of web application program such as video games to applications for data processing, software development and entertainment.

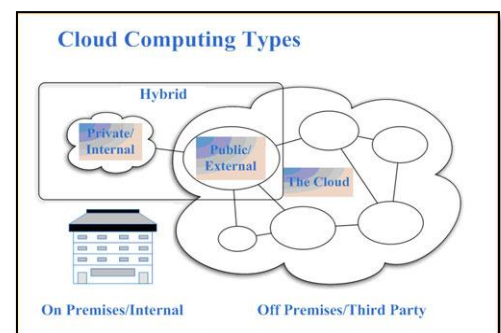
A central server administers the system, monitoring traffic and client demands to ensure everything runs smoothly. It follows a set of rules called **protocols** and uses a special kind of software called **middleware**. Middleware allows networked computers to communicate with each other.

CLOUD COMPUTING ENVIRONMENT

The cloud computing environment consists of multiple types of cloud based on their deployment and usage. Following are the types of cloud computing:

Public Cloud

A public cloud sells services to anyone on the Internet. (Currently, Amazon Web Services is the largest public cloud provider). Public cloud services may be free or offered on a pay-per-usage model. This environment can be used by general public.



The main benefits of using a public cloud service are:

- Easy and inexpensive set-up because hardware, application and bandwidth costs are covered by the provider.
- Scalability to meet needs.
- No wasted resources because you pay for what you use.

Following are the characteristic a public cloud service:
CODE TO REMEMBER: S.A.L.S.A.
(a) Scalable:

Resources and the users in the public code are large and service provider has to grant all the requests. Hence public clouds are considered to be scalable. (Able to be changed in size or scale.)

(b) Affordable:

In this case, user pays for that only for what he or she is using and this don't involve any cost related to the deployment

(c) Less Secure:

Since it is offered by third party and they have full control over the cloud, as such it is less secured as compared to on-premises public cloud.

(d) Stringent SLAs:

Since there is Service level agreement between the service provider and users, and reputation of the service provider is dependent on that, they follow the SLA very strictly.

(e) Available:

It is highly available since anyone can link to the public cloud with the proper permission.

Private Cloud

A private cloud is a proprietary network or a data center that supplies **hosted services to a limited number** of people. These are typically deployed within an organization's own internal ecosystem, often leveraging the organization's own private data center. Private clouds typically rely on the organization having trained IT staff onsite to manage the private cloud ecosystem.

Private cloud (also called internal cloud or corporate cloud) is a marketing term for a proprietary computing architecture that provides hosted services to a limited number of people behind a firewall.

This private cloud can be managed by:

- (a) On-Premise Private Cloud: **Cloud can either private to organization & managed by single entity**
- (b) Outsourced Private Cloud: **Private cloud managed by third party.**

Following are the characteristic of Private Cloud:**(a) Secure:**

Private cloud is being managed by organization itself, hence less chance of data being stolen and leaked out.

(b) Central Control:

Private cloud is managed by organization itself so there is no need of relying on the outside agency hence results in central control by the entity.

(c) Weak Service level Agreement:

SLAs are agreement between user and the service provider. However, in case of private cloud the SLA is weak since this type of networking is between the organizations & user of the same organization.

Following are the advantages of Private Cloud:

Before going in to details of advantages, let assume that you are working in an organization where there is much emphasis on IT related security.

So, here I am dividing the benefits into 2 parts:

(a) For Organization:

- Improves the average server utilization, usage of low cost servers & hardware.
- Small in size...Controlled and maintained by the organization.

(b) For Users:

- Provides high level of security and privacy to the users.

Now will study the difference between the on premises & outsourced private Cloud:

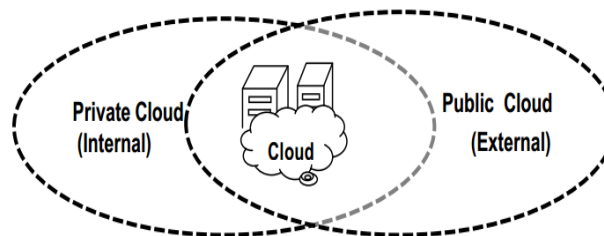
CODE TO REMEMBER: P.M. - N.S.D.L.
PM (Prime minister) in NSDL

Point Of Difference	On-Premise Private Cloud	Outsourced Private Cloud
Performance	Performance of the cloud depends on the network that organization possesses.	Performance of cloud depends on third party that is outsourcing the cloud.
Management	Managed by the organization itself.	Managed by the third party.
Network	Network related issues are easy to resolve.	Since cloud is fully deployed at third party site & is connected to entity via internet etc.
Service Level Agreement	Here users have broader access rights since and service providers are able to provide efficient services because of small user base.	SLAs' are usually followed strictly as it is third party organization.
Data Privacy & Security	Data is secured and network is more resistant to the attacks.	Cloud is relatively less secure and chances of threat.
Location	Cloud is distributed over several places & accessed using internet. Data is stored where cloud users are present.	Cloud is located offsite and data need to be transmitted through long distances.

Hybrid Cloud

A hybrid storage cloud uses a combination of public and private storage clouds. Hybrid storage clouds are often useful for archiving and backup functions, allowing local data to be replicated to a public cloud.

For example, an organization may choose to run an ERP system from their private cloud, and utilize a public cloud for offsite backup and disaster recovery purpose.



Following are the characteristics of the Hybrid Cloud:

(a) Scalable:

Hybrid has the property of public cloud hence scalable.

(b) Partly Secure:

Public cloud is more vulnerable and is subject to high risk of security breach. AS such hybrid is not fully secure, hence partly.

(c) Stringent SLAs:

Since there is Service level agreement between the service provider and users, and reputation of the service provider is dependent on that, they follow the SLA very strictly.

(d) Complex Cloud Management:

Since hybrid model comprises of one or more deployment models & users are also very large.

Community Cloud

Here the cloud is being shared by person(s) of one community and hence the name. In this type of cloud infrastructure is provisioned by a specific community. For e.g. **mission security requirements** etc.

Following are the characteristic of the community Cloud:

(a) Cost effective:

Since community cloud is being shared by several organization, the community cloud is cost effective too.

(b) Partly Secure:

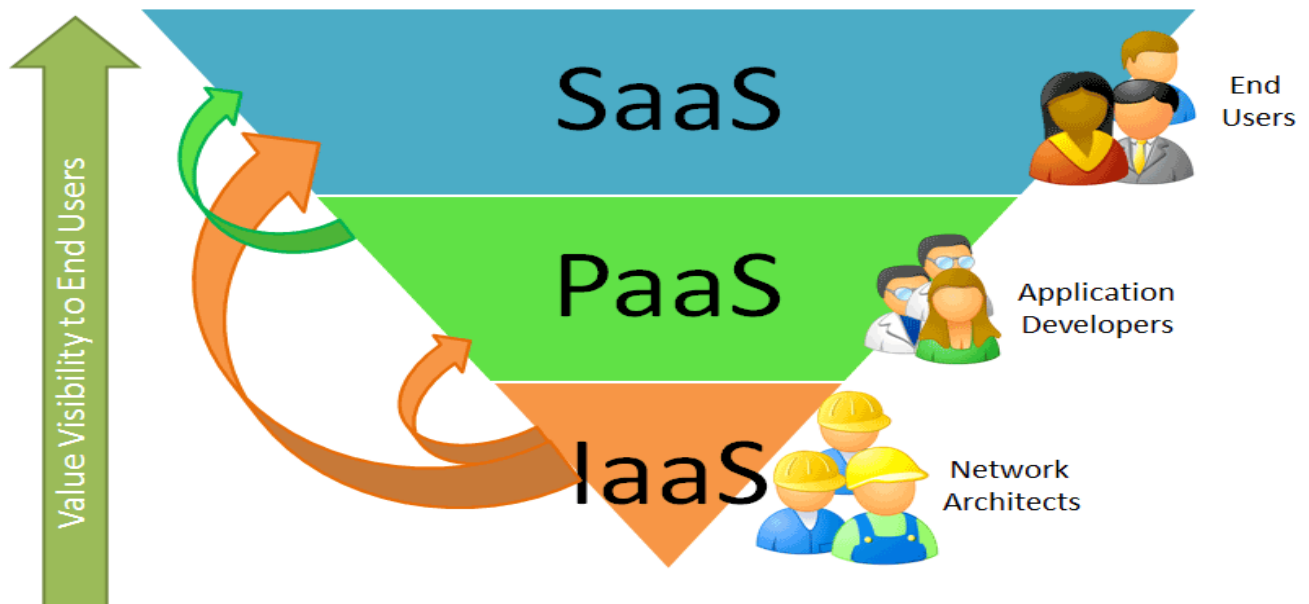
Community cloud is more vulnerable and is subject to high risk of security breach since different organization share the cloud.

(c) Collaborative & Distributive Maintenance:

Since there is sharing of the cloud among various organization, as such the control is distribute and hence better cooperation provides better results.

CLOUD COMPUTING SERVICE MODELS

Cloud computing service providers offer their services on the lines of several fundamental models:



INFRASTRUCTURE-AS-A-SERVICE (IaaS)

Infrastructure-as-a-Service providers provide an alternative to buy and install the software and the equipment which are needed to support the business operations. The servers and the networks that are required to provide the storage, server functions and networks are provided by this IaaS vendor. Example of IaaS provider includes **Amazon, EC2, Dyn DNS, Google chrome engine** etc.

IaaS provides you the computing infrastructure, physical or (quite often) virtual machines and other resources like virtual-machine disk image library, block and file-based storage, firewalls, load balancers, IP addresses, virtual local area networks etc.

Following are the services provided by the IaaS provider:

Compute	It includes virtual CPU and main memory for virtual machines.
Storage	Provide back end storage for virtual machine images.
Network	Provides virtual networking components e.g. routers, switch, bridges etc.
Load Balancers	Provide load balancing capability at the infrastructure layer.

Following are characteristics of IaaS:

CODE TO REMEMBER: **M. – W.I.S.E.**

(a) **Management** is centralized:

Resources distributed across different places to be controlled from any management console that ensure effective resource management.

(b) **Web** access to the resources:

IaaS enables the users to access the infrastructure resources over the internet.

(c) **Infrastructure** sharing :

In IaaS, different users share same physical infrastructure and thus ensure high resource utilization.

(d) Metered **Services**:

IaaS allows the user not to buy the computing resources but to rent them. The user will be charged as per the usage.

(e) **Elasticity** & dynamic Scaling:

IaaS service provider can increase or decrease the usage of the resources depending on the load.

Different instance of IaaS are as follows:

(a) **Network-As-A-Service (NaaS):**

- Provides the user with data communication capacity to accommodate bursts in data traffic.
- It provides user to access virtual network services provided by the service provider,
- Over the internet on pay-per-use basis

(b) **Storage as a Service (STaaS):**

- Provides the storage infrastructure on a subscription basis who wants low cost way to store data.
- STaaS allow the user to access the files at any time from any place.

(c) **Database as a Service (DBaaS):**

- Provides the user mechanism to create, store & access database at host site.
- Users don't have to pay-per-use basis and can access database.
- End user can access the database through web user interface.

(d) **Backend as a Service (DBaaS):**

- Provides the mobile app and web developer a way to connect their application to backend cloud storage.

(e) **Desktop as a Service (DTaaS):**

- Users can use the desktop virtualization without spending on infrastructure.
- Here service provider manages the backend responsibilities of data storage, backup, security etc.
- Users are responsible to secure & manage their own desktop images, applications etc.

(f) **Platform as a Service (PaaS):**

- PaaS is a category of cloud computing that provides a platform and environment **to allow developers to build applications and services over the internet.**
- Platform as a Service allows users to create software applications using tools supplied by the provider.
- PaaS services can consist of preconfigured features that customers can subscribe to; they can choose to include the features that meet their requirements while discarding those that do not.

Characteristics of PaaS are given below:

CODE TO REMEMBER: W- S.C.O.D.A.

- (a) **Web access to development platform:**
PaaS provides helps the developer to create, modify, test & deploy different applications.
- (a) **Scalability:**
PaaS ensure that applications built are capable of handling the varied loads efficiently.
- (b) **Collaborative Platform:**
To enable collaboration among developers, most of PaaS provider provides tools for project planning and communication.
- (c) **Offline Access:**
IaaS allows the user not to buy the computing resources but to rent them. The user will be charged as per the usage.
- (d) **Diverse Client Tool:**
PaaS provider offers wide variety of client tools like web user interface, application programming interface etc.to help the developers to choose the tools of their choice.
- (e) **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.

SOFTWARE-AS-A-SERVICE (SAAS)

Software-as-a-Service is cloud service where consumers are able to access software applications over the internet. **The programs which are developed by the software developers are accessed by the customers through the browser and pay the fees for their usage.** Users don't have to worry about the installation, setup and running of the application. Service provider will do that.

For example, **one can make** documents in goggle doc online.

Now, we will study the service provided by the SaaS and its characteristics:

Services Provided by SaaS	Business Services SaaS provide variety of business to start up their companies. Social Network:
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	Cloud computing helps in handling the load since the number of internet users increasing by many folds. Document Management: Service provider provides services to create, manage electronic documents. Mail Services Most of the email providers offer their services as SaaS services.
Characteristic by SaaS Code To Remember W.O. - C.A.M.	Web Access: User can use application from any location of device is connected to internet. One to many: Single application can be used by multiple users. Centralized Management: SaaS services are managed from a single location as such there is centralized control. Availability: SaaS ensures almost 100% availability of data. Multi-device Support: SaaS can be accessed from any devices e.g. desktop, mobile, laptop etc.

Following are the different instance of SaaS:

- (a) Testing as a service (TaaS): **Provides software testing facilities.**
- (b) API as a service (APIaaS): **Allows users to explore functionality of web services.**
- (c) Email as a service (EaaS): **Provides users with an integrated system of emailing, office automation, and records management and integration services.**

Other cloud service modules:

- (a) Data as a service (DaaS):
 - Provides data on demand to multiple users.
 - Data may include images, sounds and videos.
 - DaaS users have access to high quality data in a centralized place & pay by volume or data type needed.
- (b) Security as a service (SECaaS):
 - Service given to the user to access the security service provided by the service provider on pay basis.
 - It is new approach where cloud security measures are present within cloud.
 - It ensures that cloud users will be protected within cloud.

(c) Identity as a service (IDaaS):

- Provides users to access the authentication infrastructure that is,
- Being built, managed and provided by third party service provider.

CHARACTERISTIC OF CLOUD COMPUTING:

CODE TO REMEMBER: **V- P.M. – M.A.R.S.**
V PM (Prime minister) on MARS

a) **VIRTUALISATION:**

- This technology allows server and storage device to share & utilize applications by easy migration from one physical server to other.

b) **PERFORMANCE:**

- It is monitored & consistent & coupled architectures are constructed using web services.

c) **MAINTENANCE:**

- The cloud computing applications are easy to use and need not be installed at each computer.

d) **MULTI-SHARING:**

- Cloud computing working in shard manner, multiple users can work more efficiently with reduced cost by sharing common infrastructure

e) **AGILITY:**

- The cloud works in “**distributed mode**” environment. It shares resources among users and tasks, whole improving efficiency.

f) **REALIBILITY AND AVAILABILITY:**

- Availability of server is supposed to be high and more reliable so as to ensure minimal infrastructure failure.

g) **SCALABILITY:**

- Cloud environments enable servicing of business requirements for larger users.

ADVANTAGES OF CLOUD COMPUTING:

CODE TO REMEMBER: **I. – C.A.R.D.S.**

a) **INTegration OF SOFTWARE:**

In the cloud, software integration is usually something that occurs automatically. This means that you do not need to take additional efforts to customize and integrate your applications as per your preferences. Cloud computing allows you to customize your options with great ease. Hence, you can handpick just those services and software applications that you think will best suit your particular enterprise.

b) COST EFFICIENT:

It is s probably the most cost efficient method to use, maintain and upgrade. The cloud computing 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.

c) ACCESS TO INFORMATION:

Once you register yourself in the cloud, you can access the information from anywhere, where there is an Internet connection. This convenient feature lets you move beyond time zone and geographic location issues.

d) RECOVERY:

Since all your 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. This makes the entire process of backup and recovery much simpler than other traditional methods of data storage.

e) DEPLOYMENT:

Cloud computing gives you the advantage of quick deployment. Once you opt for this method of functioning, your entire system can be fully functional in a matter of a few minutes. Of course, the amount of time taken here will depend on the exact kind of technology that you need for your business.

f) STORAGE:

Storing information in the cloud gives you almost unlimited storage capacity. Hence, you no more need to worry about running out of storage space or increasing your current storage space availability.



CHALLENGES TO CLOUD COMPUTING

1. AVAILABILITY:

The goal of availability for Cloud Computing systems (including applications and its infrastructures) is to ensure its users can use them at any time, at any place. It ensures back up of data through BCP, DRP. Cloud computing system enables its users to access the system (e.g., applications, services) from anywhere. This is true for all the Cloud Computing systems.

2. CONFIDENTIALITY:

Prevention of data access from unauthorized disclosure referred to as confidentiality. Cloud works on public network therefore it is imperative to keep the data confidential. This can be done through encryption of data or by way of physically secure at separate location.

3. **INTEGRITY:**

Integrity means prevention of data from unauthorized modification of data and ensures that data is of **high quality, correct, accessible and correct**. On cloud network it should be ensured that data is not changed. **Redundant Array of Independent Risks (RAID)** is one of the way to preserve integrity on the cloud computing.

4. **GOVERNANCE:**

Since on cloud computing there is no control over the employees and services, it creates problems like **design, implementation, testing** etc. So there is need to put up governance model that will control the **standards, policies and procedures** of the entity.

5. **TRUST:**

Deployment model provide a trust to cloud environment. An entity has direct control over its security issue. Trust is an important issue in the cloud. Trust ensures that service arrangements are sufficient to allow visibility into security and privacy controls.

6. **LEGAL ISSUES AND COMPLIANCES:**

There are various data, security laws that to be complied with by the entity. There is need to understand various types of rules and laws that imposes security and privacy duties on the organization.

7. **PRIVACY:**

It is one of the important issue in the cloud computing. The privacy issues are embedded in each phase of cloud design. The cloud should be designed in such a way that it decreases the privacy risks.

8. **AUDIT:**

It emphasis on “What is happening in the cloud environment”. It is being hosted on the virtual machine to watch “what is happening in the system”. The context of use of clouds, time consuming audits seriously detains the key gain of cloud agility.

9. **DATA STEALING:**

In cloud computing, data is accessible by everyone and from anywhere. There may be the chances where the cloud provider uses infrastructure of some other service provider. As such, data is less secured and is prone to concept of “data stealing”.

10. **ARCHITECTURE:**

In cloud computing model, there should be control over security and privacy of the system. Its reliable and scalable infrastructure depends on **design and implementation** to support the overall framework.

11. INCIDENT RESPONSE:

It ensures to meet the organization's requirement during an incident. It ensures that cloud provider has a transparent response process in proper place. Affected network, applications, exposed intrusion helps to understand an incident response.

12. SOFTWARE ISOLATION:

Software isolation is a way to understand virtualization and other techniques that the cloud owner employs in software architecture and evaluate the risks required for the organization.

13. APPLICATION SECURITY:

It applies when application moves to cloud platform. Service provider should have complete access to server with all rights to ensure protection of the application. Infected application need to be monitored and recovered by the cloud security drivers.

4. MOBILE COMPUTING:

Mobile Computing: A 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. An extension of this technology is the ability to send and receive data across these cellular networks. This is the principle of mobile computing.

Mobile data communication has become a very important and rapidly evolving technology as it allows users to transmit data from remote locations to other remote or fixed locations. This proves to be the solution to the biggest problem of business people on the move - mobility.

HOW MOBILE COMPUTING WORKS

1. User enters or access data using the application on handheld computing devices.
2. Using one of the several connecting technologies, new data transmitted from handheld to site's information system where files are updated and new data is accessible.
3. Now both system have same information and are in sync.
4. The process work the same way starting from the other direction.

The process is similar to the way a worker's desktop PC access entity's applications, except that user's device is not physically connected to organization system.



COMPONENTS OF MOBILE COMPUTING

(a) **Mobile Communication:**

- Refers to infrastructure to ensure that seamless & reliable connection goes on.
- It includes properties, protocols and data formats etc.

(b) **Mobile Hardware:**

- Component that receives the service of mobility e.g. Mobile Hardware includes laptops, smart phones etc. ---
- At backend various application, database servers allows device to communicate with internet.
- Characteristic of mobile computing hardware depends on size, form factor, primary or secondary storage.

(c) **Mobile Software:**

- Program that runs on the mobile hardware & deals with requirement of mobile application.
- It is operating system of the device that makes the device operate.

LIMITATION OF MOBILE COMPUTING:

CODE TO REMEMBER: B.S.P. - H. – H.T.

BSP Hawala in **H**industan **T**imes

(a) **Bandwidth insufficient:**

- It is slower than direct cable connections.
- These networks are usually available within the range of phone tower.

(b) **Security standards**

- When mobile connects, one is dependent on public network i.e. use of virtual Private Network.
- One can easily attack VPN since a huge number of networks interconnected with the line.

(c) **Power consumption:**

- In case of mobile, without power a mobile is dependent on the battery inbuilt in it.
- As such to ensure mobile working for longer time, expensive batteries are used.

(d) Human interface with the device:

- Usually input device in mobile such as keyboard is small in size and as such hard to use.
- This will indeed result in problem in communicating.

(e) Health Hazards:

- People often use phone while driving which is a major cause of accidents.
- It is hazardous to health, as it is believed that cell phone signals may cause problems.

(f) Transmission Interface:

- Any geographical conditions may hinder the good transmission for e.g. hilly areas, tunnel etc.

ISSUES IN MOBILE COMPUTING:**CODE TO REMEMBER: C - S.B.P. – P.L.R.**

C State Bank of Patiala's Prime Lending Rate

(a) Challenges of Business :

- It is slower than direct cable connections.
- These networks are usually available within the range of phone tower.

(b) Security standards

- When mobile connects, one is dependent on public network i.e. use of virtual Private Network.
- One can easily attack VPN since a huge number of networks interconnected with the line.

(c) Bandwidth:

- It can be improved by logging and compression of data before transmission.
- The cached data can help improve query response time.

(d) Power Consumption:

- Mobile computers will rely on their batteries as primary power source.
- Batteries should be ideally as light as possible as well as for longer times. Power consumption is to be minimised for increasing battery life.

(e) Performance & end-to-end design:

- Mobile computing involves multiple networks, application server platform, end-to-end compatibility;
- Server capacity design and network response time estimates are difficult to achieve.

(f) Location Intelligence:

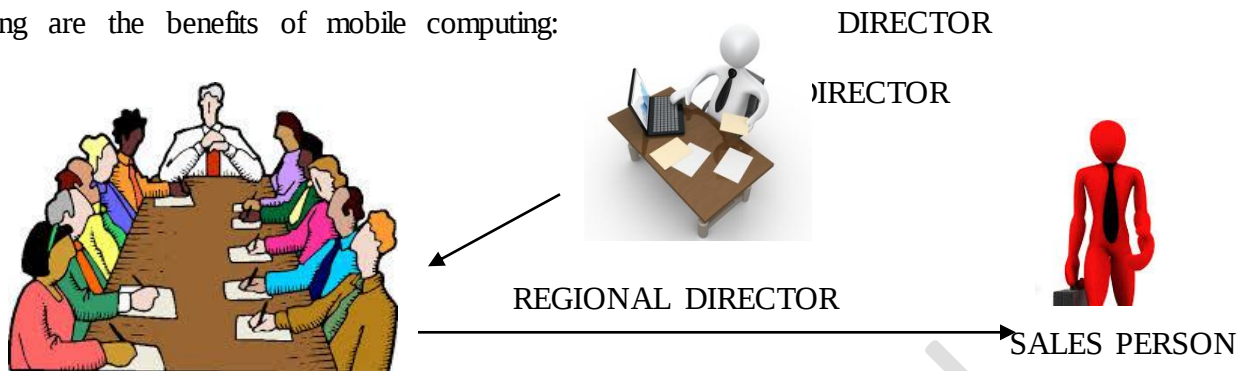
- As mobile computer moves, they encounter networks with different features.
- A mobile computing must be capable of switching from infra-red mode to radio mode as it moves to outdoor.

(g) Reliability, coverage, capacity and cost:

- Wireless network has less reliability and less geographical coverage and reduced bandwidth.
- These are slower, cost more than wired-line network services.

MOBILE COMPUTING BENEFITS

Following are the benefits of mobile computing:



Let illustrate the mobile computing benefits with an example:

In a company there is a **director** name **Mr. A** and he has a subordinate **Mr. B (who is in meeting)**, **regional director of Faridabad region**, has a **field boy Mr. C** who does all the marketing work. Now we will discuss the benefit of mobile computing:

1. Mobile computing enables to access to work details like order status, contact information, service contracts etc. (**Mr. B meeting में है and he require all data related to contract**)
2. It enables mobile salesperson to **update work order status** in real time. (**Mr. C जो field work में है will update his work when finished**)
3. Mr A (director) of company can access the corporate complete information from anywhere and at any time. (**Mr. A देख सकते हैं at any time, the information about the contract.**)
4. Provide remote access to corporate knowledge base at job location.
5. Improves management efficiency by enhancing quality information, excellent information communication etc.

5. GREEN COMPUTING:

GREEN IT refers to **study and practices of establishing/using computers and IT resources** in a more efficient and environmentally friendly way. Computers indeed use lot of natural resources such as power and problems of disposing them.

“It’s the study and practice of 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.”

Steps being taken under the **GREEN IT** which are as follows:

- **Power down of CPU when it is inactive.**
- **Power up and down peripherals such as laser printer according to needs.**

- Use of notebooks rather than desktops.
- Minimize the use of papers and properly recycle waste papers.
- Dispose e-waste as per central, state and local regulations.

GREEN IT BEST PRACTICES

Here are some of the well-defined best practices:

- Involving the stakeholders on campus yield policies & green initiative more likely to be embraced by the campus community.
- Guidelines for using best practices simplify adoption of green IT by campus users.
- On-going communication about and campus commitment to green IT best practices to achieve notable results.
- Partnering takes advantage of existing efforts and ensures wider reach.
- Develop a sustainable green Computing plan:
 - Involve stakeholders to include checklist, recycling policies for disposal of used components & equipment.
 - Involve power usage, reduction of consumption of papers, recycling old machines & equipment.
 - Use cloud computing so that multiple organizations share same computing resources.

RECYCLE:

- Dispose e-waste as per regulations.
- Discard unwanted equipment in environmentally responsible manner.
- Manufacturers must provide option how to dispose equipment when become unusable.

ENVIRONMENTALLY SOUND PURCHASE DECISIONS:

- Purchase of laptops, desktops based on environmental attributes.
- Clear policy in respect of designing of the product.

REDUCED PAPER CONSUMPTION:

- More use of emails resulting in saving of papers.
- For marketing, advertising on-line marketing is best and will reduce paper wastage.
- Use both side of paper while printing any document.

6. BYOD:

BYOD is an abbreviation for **BRING YOUR OWN DEVICE**, and refers to the idea of people bringing their personally-owned computing devices, such as laptops, tablets or smart phones, for use at their place of work. It commonly refers to employees bringing along their own devices to the office in order to access corporate networks and business data etc.

From employee perspective: Use of personal devices may be more convenient and user-friendly, thus enhancing employee morale and productivity, and making the company look like a flexible, attractive employee,

From employer perspective: It can be advantageous for businesses because it saves money on the purchase of computing equipment and removes the need for extensive IT support, therefore allowing companies to concentrate on broader issues. BYOD policy has rendered the workplaces flexible, empowering employees to be mobile and going them right to work even beyond their working hours.

ADVANTAGES OF BYOD

- Employees use their own devices at work. It lowers the burden since they have to take only their device not the organizational device.
- Since employee bring their own device, this result in decrease in outlay of the organization. (Organizations need not to purchase the devices for their employee).
- Since, devices are of employee there is cost saving since IT doesn't have to provide and user support and maintenance activities.
- In case of self device, user is efficient in working on its own device. In case it works on other devices some learning phase is included.

EMERGING THREATS OF BYOD

CODE TO REMEMBER: **A – D.I.N.**

1. **APPLICATION RISKS:**

It is in general context that employee's phone or smart devices that are connected to corporate network are not protected by security software. Due to increased use of mobile and like devices the vulnerabilities have increased consequently.

2. **DEVICE RISKS:**

It is exemplified (illustrated) in “**Loss of Device**”. Lost or stolen computer device or mobile phones can result adverse impact on the company as these devices contains vital information about the company. With ease access to company mails one can easily obtain the trade secrets of the organization.

3. **IMPLEMENTATION RISKS:**

It is exemplified and regarded as “**Weak BYOD policy**”. BYOD implementation must not cover only the technical aspects but also demand for robust (strong) policy too. A weak BYOD policy may result in failure of communication of employee expectations; thereby increase the chances of device misuse.

4. **NETWORK RISKS:**

It is exemplified and regarded as “**Lack of device visibility**”. When employee uses the company assets, then IT part of organization has full control over such devices and have complete visibility of devices connected to the network.

As BYOD involves use of personal devices, IT is unaware of number of devices connected to the company network. For instance, any virus is detected in the network as such it is imperative to scan all connected devices. Since complete visibility is not there, it may be possible that some devices may not get covered under scanning program. This is hazardous for the company.

7. SOCIAL MEDIA AND WEB 2.0 :

SOCIAL MEDIA:

A set of entities connected with each other on a logical or a physical basis. Physical networks like computer networks are those that can be planned, implemented and managed very optimally and efficiently. When we move from physical to logical networks, the visualization becomes much more difficult. A social network is usually created by a group of individuals, who have a set of common interests and objectives.

WEB 2.0:

Web 2.0 is the term given to describe a second generation of the World Wide Web that is focused on the ability for people to collaborate and share information online. Web 2.0 basically refers to the transition from static HTML Web pages to a more dynamic Web that is more organized and is based on serving Web applications to users. The components of Web 2.0 help to create and sustain social.

COMPONENTS OF WEB 2.0:

Following are the components of Web 2.0:

CODE TO REMEMBER: C- PF – B.M.W.



1. **COMMUNITIES** :

- These are online space formed by a group of person to share their thoughts, ideas, etc.
- These are cost effective as well as easy to use.

2. **PODCASTING**:

- Podcasts enable engaging learning through multimedia content; interest groups in e-learning can access the relevant content as and when they need.



3. **FOLKSONOMY**:

- Folksonomy allows user to tag their content online and others can easily view the contents.

4. **BLOGGING** :

- Blog gives users of social network to share or express their thoughts in a free form basis.

5. **MASHUPS**:

- Mashups is the process by which people on the internet can congregate services from various vendors to create completely new service. For example, you could combine the addresses and photographs of your library branches with a Google map to create a map mashup.

6. WIKI:

- It is set of correlated pages on the particular subject and allows the users to share the content of the same.

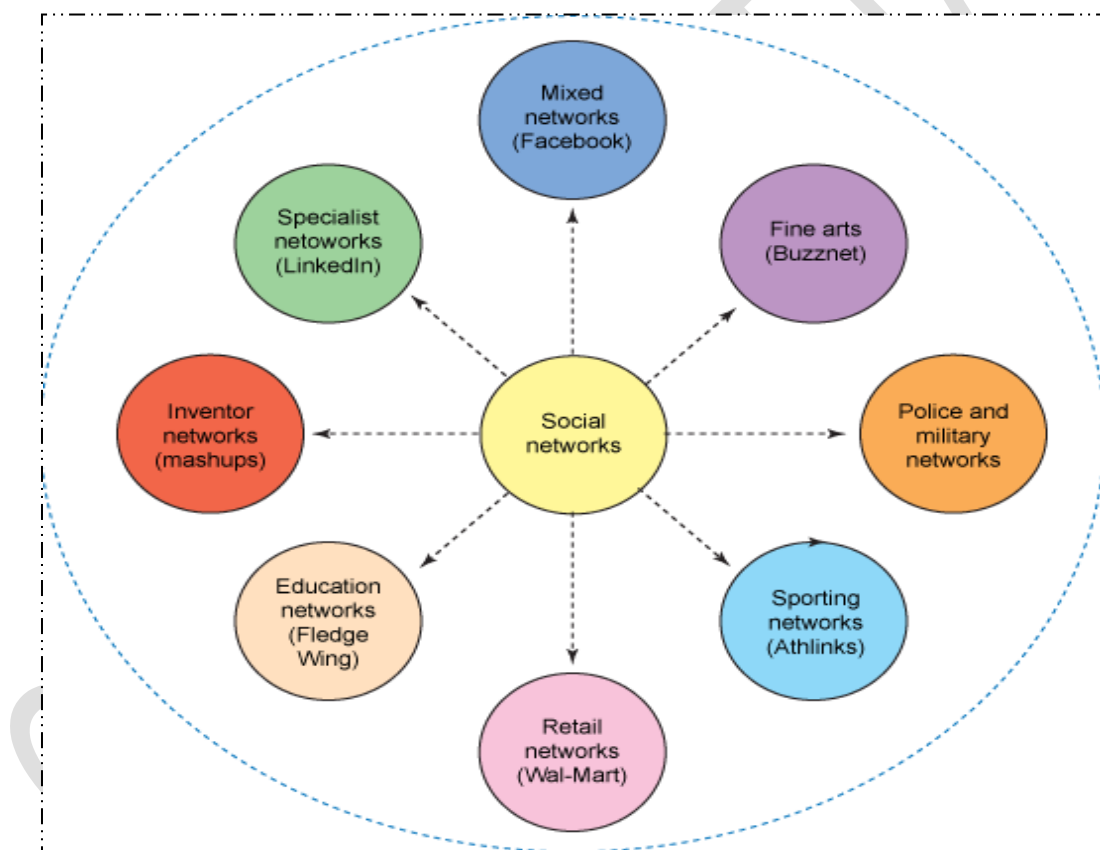


TYPES AND BEHAVIOR OF SOCIAL NETWORKS

The nature of social networks makes for its variety. We have a huge number of types of social networks based on needs and goals. Compartmentalizing social networks is quite a challenging activity which we have tried to do in this paper. Social networks exist in various domains - within and outside organizations, within and outside geographical boundaries, within and outside social boundaries and many other areas. Such huge variations make the reach of social networks grow to all sectors of the society. Keeping these in mind, the main categories identified are given below:

Social Contact Networks	These types of networks are formed to keep contact with friends and family and are one of 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.
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. A very good example for this type of network is LinkedIn .
Networks for fine arts	These types of social networks are dedicated to people linked with music, painting and related arts.
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.
Sporting Networks	These types of social networks are dedicated to people of the sporting fraternity. Eg: Athlinks .
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.

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 are Technical Forums and Mashup centers.
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.
Others	Apart from the networks outlined above, there are multiple other social networks which serve a huge number of the internet population in multiple ways.

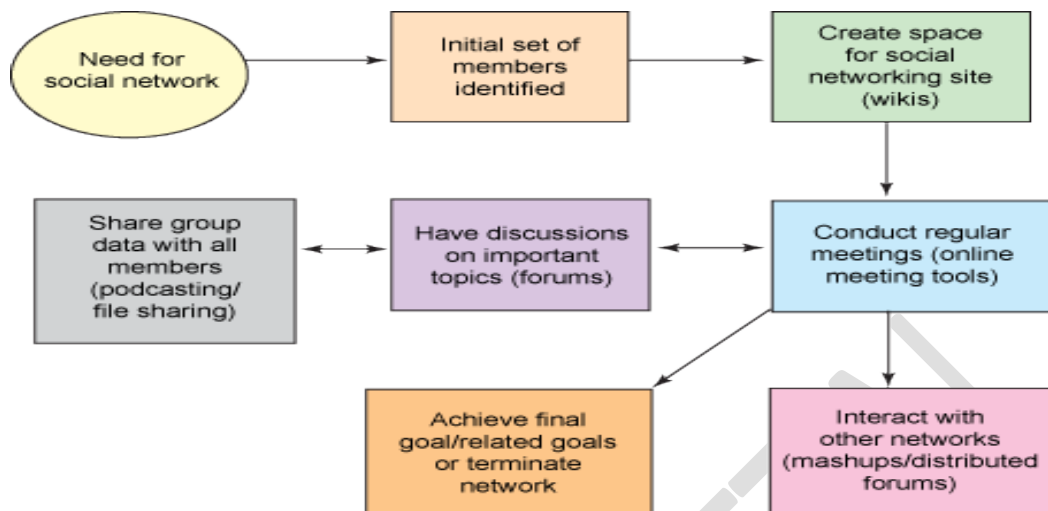


TYPES LIFE CYCLE OF SOCIAL NETWORKS

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. Consider the diagram below. For all the steps in the life cycle Web 2.0 has provided tools and concepts which are not only cost effective but very easy to implement.

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.



IMPACT OF SOCIAL NETWORKS USING WEB 2.0

Social networks built on Web 2.0 concepts has become so cost affordable and easy to use that more and more people are migrating to this wave. This has also helped NGO's and other social service organizations to create meaningful social networks to reach out to people in a much more structured manner and in turn benefit the needy and deprived sector of the society.

FUTURE SCOPE WEB 2.0 IN SOCIAL NETWORK

There are still a number of areas that need improvement so that the true power of the technology integrated with social networks can be truly be felt. A majority of social networks still operate in an offline and unstructured manner and if proper education on Web 2.0 can be imparted, then a greater number of such networks will come under the wing of social networks.

Areas like space exploration, scientific experimentation, social sciences along with the area of collaborative research through social networks are something that Web 2.0 practitioners can actively contribute in. The social impact that the technology is making via social networks is also making aware of the power and flexibility and is making Web 2.0 an integral part of social networks throughout the world.

BENEFITS AND CHALLENGES FOR SOCIAL NETWORKS USING WEB 2.0

BENEFITS:

1. Provide platform where users of the network need not to worry about the implementation or underlying technology at a very affordable cost and a very easy pickup time.
2. Concepts of Web 2.0 like blogging are some things that people do on a day to day basis and no new knowledge skills are required.
3. People are coming much closer to another and all social and geographical boundaries are being reduced at intense speed.
4. Increases the social collaboration to a very high degree and this in turn helps in achieving the goals for a social network

CHALLENGES:

1. Provide platform Chances are there where there may be huge chance of data leak and confidentiality loss because there are usually no centrally mandated administrative services to take care of such things.
2. Malicious users somehow manage to perpetrate the social networks resulting in to penetration in privacy of individual users.

WEB 3.0

Web 3.0 is also known as **semantic Web**. In this sites wherein the computers will be generated raw data on their own without direct user interaction. Web 3.0 uses semantic web technology, drag and drop mash, and consolidation of web content depending on the interest of individual user.

It is based on the “DATA WEB” technology, which contains the data records publishable and reusable through query format. These systems are capable to think of its own and find the most preferable answer to the query of the user.

Important **3 components of Web 3.0** are as under:

(a) Semantic Web:

Provides the user a common platform where data can be used across various organisation, applications and community boundaries. The data is readily available so that machines are able to analyse the data on their own.

(b) Web Services:

It is software that supports computer-to-computer interaction over the internet.