CHAPTER 6

6. Internet and Intranet Systems Development 6 Hrs.

6.1 Introductions

Internet

- Internet is a world-wide/global system of interconnected computer networks.
- Internet uses the standard Internet Protocol (TCP/IP)
- Every computer in Internet is identified by a unique IP address.
- IP Address is a unique set of numbers (such as 110.22.33.114), which identifies a computer location.

- A special computer DNS (Domain Name Server) is used to give name to the IP Address so that user can locate a computer by a name.
- For example, a DNS server will resolve a name **http://www.1-infiniteloop.com** to a particular IP address to uniquely identify the computer on which this website is hosted.
- Internet is accessible to every user all over the world.

Intranet

- Intranet is system in which multiple PCs are networked to be connected to each other.
- PCs in intranet are not available to the world outside of the intranet.
- Usually each company or organization has their own Intranet network and members/employees of that company can access the computers in their intranet.

- An IP Address also identifies each computer in intranet, which is unique among the computers.

Similarities in Internet & Intranet

- Intranet uses the Internet protocols such as TCP/IP and FTP.
- Intranet sites are accessible via web browser in similar way as websites in Internet. But only members of Intranet network can access intranet-hosted sites.
- In Intranet, own instant messengers can be used as similar to yahoo messenger/Gtalk over the Internet.

Differences in Internet & Intranet

- Internet is general to PCs all over the world where Intranet is specific to few PCs.
- Internet is wider access and provides a better access to websites to large population whereas Intranet is restricted.
- Internet is not as safe as Intranet as Intranet can be safely privatized as per the need.

6.2 Benefits and drawbacks of intranets

Benefits of an intranet
Your business' efficiency can be improved by using your intranet for:

- **publishing** - delivering information and business news as directories and web documents
- **document management** - viewing, printing and working collaboratively on office documents such as spreadsheets
- **training** - accessing and delivering various types of e-learning to the user's desktop
- **workflow** - automating a range of administrative processes
- **front-end to corporate systems** - providing a common interface to corporate databases and business information systems

- **email** - integrating intranet content with email services so that information can be distributed effectively
- **better internal communications** - corporate information can be stored centrally and accessed at any time
- **sharing of resources and best practice** - a virtual community can be created to facilitate information sharing and collaborative working
- **improved customer service** - better access to accurate and consistent information by your staff leads to enhanced levels of customer service
- **reduction in paperwork** - forms can be accessed and completed on the desktop, and then forwarded as appropriate for approval, without ever having to be printed out, and with the benefit of an audit trail

- Intranet is time saving because there is no need to maintain physical documents such as procedure manual, requisition forms, and Internet phone list.
- Through Intranet common corporate culture every user can view the similar information effectively.
- Intranet offer improve teamwork through which teamwork is enabled and all certified users can get access to information.
- Intranet providing cross platform capability for UNIX, Mac, Windows.
- Intranet offering their user to write applications on their browser without cross-browser compatibility issues.
- Intranet is a Web-based tool that permits users to produce a customized site according their requirements. You can pull all Internet actions and most wanted contented into a single page, which make easier to access.

Why Intranet?

Although, the concept of Intranet draws heavily on the Internet technology, the need for Intranet arises more from the business pressures to transform the way business is conducted.

Some of the important factors responsible for the popularity of Intranet are listed below:

(a) Need to cut costs:

The cost effectiveness is the mantra in the competitive world of today. Intranet attempts to streamline flow of information and is user directed. That saves on time and cost of communicating information.

(b) Dynamics of markets:

Today, changes take place more rapidly in the market and company than ever before. Therefore, the information needs to be reported and exchanged more quickly among all those associated with the company, including employees, customers and vendors.

(c) Changing work environment:

As the business and markets become scattered, employees have to be mobile and away from office. Thus, it becomes imperative for the workforce to use less expensive means of communication to remain in touch with the office.

(d) Customer support:

The increasing role of customer support in the marketing strategy has changed the whole concept of communication in enterprises. A direct contact of the customer with the customer support department through Intranet directs the 'job to specialist' and ensures better handling of complaints.

The related advantage is that it also permits the sales force to look after more crucial problems than to act as intermediary between the customer and customer support department for the routine kind of complaints.

Advantages:

The advantages of Intranet over the conventional communication systems can be listed as below:

1. Intranet is an easy, economical and fast system of communication within the enterprise. It offers opportunities to keep every concerned individual informed irrespective of the location. It also helps in reducing travel time as the communication between people in the business enterprise can be more frequent and less expensive, particularly when the persons desiring to communicate are located far away from each other.

2. It serves information automatically and thus, one does have to face the contempt of not being aware of an important piece of information. Thus, demand for information is more frequent and detailed.

3. Intranet replaces gossip as it permits inter- employee communication with more transparency and free expression of views. It enables employees at various levels to pose problems/questions, participate in discussions and contribute answers to thorny problems of the company. The concept of collective expertise can be given a concrete shape with the help of Intranet.

4. It improves productivity of the manager. With Intranet, the manager can spend more time in analyzing information and not in seeking information and waiting for its delivery.

5. Intranet helps in eliminating the latency of information in the enterprise and makes the flow of information need-driven than availability-driven.

Disadvantages:

The disadvantages of Intranet are few and can be overcome by proper planning and support from the top management. Some of the important disadvantages are as follows:

1. One of the major disadvantages is the risk of security to the corporate information resource. The intranet exposes the corporate information resource to the risk of loss of privacy and even unauthorized alteration. The Intranet technology is still quite fragile and the risk of security and privacy of information on Intranet is higher.

2. Intranet poses another challenge before the enterprise and that relates to the need to change the work culture for effectiveness of the Intranet. The executives, particularly at the top level of managerial hierarchy are in the habit of delegating the handling of information, including mail to their secretaries.

Quite often, the e-mails are printed out by the secretaries and dumped on the table of the executive by the secretary. The practice of sharing passwords with secretaries could be fatal for the executive and the enterprise, in case of over ambitious or dissatisfied secretary. Another cultural change that is necessary is in the speed of response.

As the Intranet communications are convenient and less expensive, the number of mails/queries is likely to increase and if these are not responded to quickly, they will pile up and the order will give way to chaos in the enterprise.

3. Another fear that is being talked about these days is the danger of reduced face-to-face interaction between employees leading to impersonalisation of the enterprise.

Advantage of Sharing of Information

- The functionality of intranets can enable greater sharing of information, and collaboration, across the organization. Documents can be stored centrally and accessed by anyone with the appropriate clearance. Printers can be controlled centrally. Bulletin boards, search engines and directories can be added to further facilitate the flow of information. Task-management functions and calendars can be added to greater assist cross-functional teams. Online training can also be made available to further resource employees.

Advantage of Security

- Data security is a major concern of any business and the intranet adds extra concerns in this area. All information is password protected, but Intranet can be customized to the individual employee, to reduce the possibility of unauthorized access to sensitive information.

Disadvantage of Cost

- In the initial setup of the intranet system, cost can be considerable. The size and complexity will determine the outlay. Ongoing upgrades and necessary maintenance and improvements can greatly add to cost overruns. Training staff to use the system can be a significant cost.

Disadvantage of Complexity

- The complexity of the system can inhibit the use of the system. Employees can perceive it to be too difficult to understand and therefore not use it to its maximum effectiveness. They may feel overloaded by the amount of information that it contains. Complexity can also add to the management needed by the IT department. Breakdowns or time offline can also be a problem that needs to be managed with such a complex system.

6.3 Protocols, Structure and Scope of Networks

[Refer: Network Protocol Structures.pps]

6.4 Intranets Resources Assessments:

Identification of resources and their capacities to build the Intranet system is known as Intranet Resource Assessments.

Network Infrastructure,

Network infrastructure is typically part of the IT infrastructure found in most enterprise IT environments. The entire network infrastructure is interconnected, and can be used for internal communications, external communications or both. A typical network infrastructure includes:

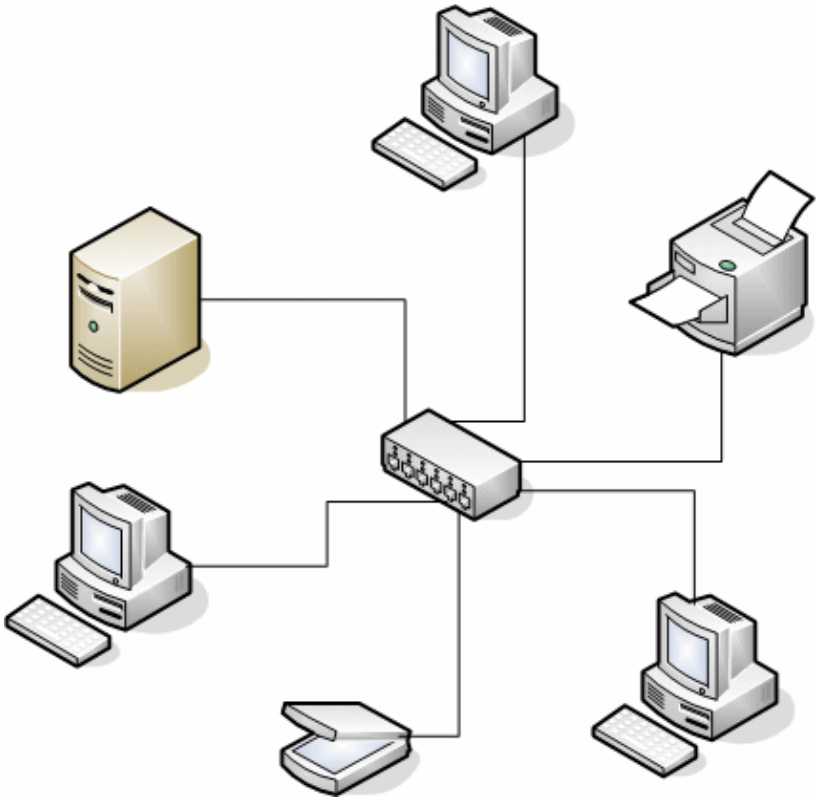
- Networking Hardware:
    - Routers
    - Switches
    - LAN cards
    - Wireless routers
    - Cables

- Networking Software:
    - Network operations and management
    - Operating systems
    - Firewall
    - Network security applications

- Network Services:
    - T1, E1 Line
    - DSL
    - Fiber to Home
    - Satellite
    - Wireless protocols
    - IP addressing

Clients and Server Resources

Client-server architecture (client/server) is a network architecture in which each computer or process on the network is either a *client* or a *server*. Servers are powerful computers or processes dedicated to managing disk drives (*file servers*), printers (*print servers*), or network traffic (*network* servers). Clients are PCs or workstations on which users run applications. Clients rely on servers for resources, such as files, devices, and even processing power.

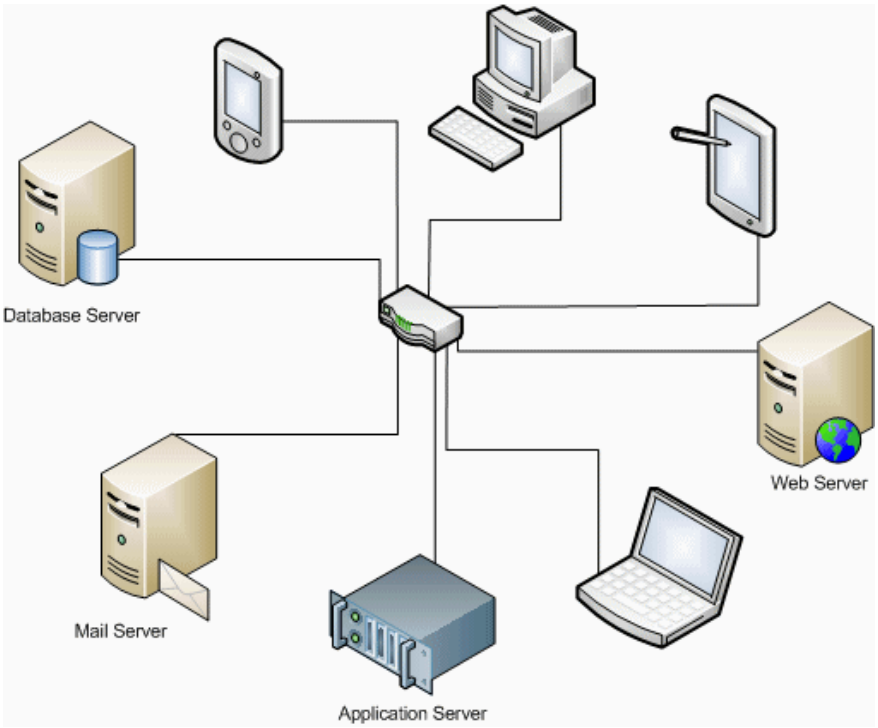


Another type of network architecture is known as a *peer-to-peer* architecture because each *node* has equivalent responsibilities. Both client/server and *peer-to-peer architectures* are widely used, and each has unique advantages and disadvantages.

Client/server is a program relationship in which one program (the client) requests a service or resource from another program (the server).

Client-server architectures are sometimes called *two-tier architectures.* Occurring on the client side of a client-server system. For example, on the World Wide Web, JavaScript scripts are client-side because they are executed by your browser (the

client). In contrast, CGIscripts are server-side because they run on the Web server. Java applets can be either server-side or client-side depending on which computer (the server or the client) executes them.



Although the client/server model can be used by programs within a single computer, it is a more important concept for networking. The client establishes a connection to the server over a local area network (LAN) or wide-area network (WAN), such as the Internet. Once the server has fulfilled the client's request, the connection is terminated. Your Web browser is a client program that has requested a service from a server; in fact, the service and resource the server provided is the delivery of this Web page.

Computer transactions in which the server fulfills a request made by a client are very common and the client/server model has become one of the central ideas of network computing. Most business applications use the client/server model as does the Internet's main program, TCP/IP. For example, when you check your bank account from your computer, a client program in your computer forwards a request to a server program at the bank. That program may in turn forward a request to its own client program, which then sends a request to a database server at another bank computer. Once your account balance has been retrieved from the database, it is returned back to the bank data client,

which in turn serves it back to the client in your personal computer, which then displays the information to you.

Both client programs and server programs are often part of a larger program or application. Because multiple client programs share the services of the same server program, a special server called a daemon may be activated just to await client requests. In marketing, the client/server was once used to distinguish distributed computing by personal computers (PCs) from the monolithic, centralized computing model used by mainframes. This distinction has largely disappeared, however, as mainframes and their applications have also turned to the client/server model and become part of network computing.

6.5 Intranet Implementation Guidelines

- Do you need an Intranet?
- What specific Problems will it solve?
- What are your available resources (time, money, and personnel)?
- Should you outsource all, some, or none of the development and operation?

6.6 Content Design, Development, Publishing and Management

Content management, is the set of processes and technologies that support the collection, managing, and publishing of information in any form or medium. When stored and accessed via computers, this information has come to be referred to, simply, as content or, to be precise, digital content. Digital content may take the form of text (such as electronic documents), multimedia files (such as audio or video files), or any other file type that follows a content lifecycle requiring management. Managing content refers to creating, editing, archiving, publishing, collaborating on, reporting, distributing website content, data and information.

A content management system is software that keeps track of every piece of content on your Web site, much like your local public library keeps track of books and stores them. Content can be simple text, photos, music, video, documents, or just about anything you can think of. A major advantage of using a CMS is that it requires almost no technical skill or knowledge to manage. Since the CMS manages all your content, you don't have to.

An example of a CMS application is a Web Application that provides the following administration, control panel or website management functionalities:

- Create, Edit, Publish, Archive web pages
- Create, Edit, Publish, Archive articles
- Create, Edit, Publish, Archive press releases
- Create, Edit, Publish, Archive blogs
- Add / Edit events into an Event Calendar
- Add / Edit Inventory (products), description, product specifications, prices, photos, etc.
- Enter, Edit, or View orders and print packing slips and invoices
- View reports and statistics site data
- Create and Edit system users which have different permission levels to different section(s) of the above administration

Content management is an inherently collaborative process. It often consists of the following basic roles and responsibilities:

- Creator - responsible for creating and editing content.
- Editor - responsible for tuning the content message and the style of delivery, including translation and localization.
- Publisher - responsible for releasing the content for use.
- Administrator - responsible for managing access permissions to folders and files, usually accomplished by assigning access rights to user groups or roles. Admins may also assist and support users in various ways.
- Consumer, viewer or guest- the person who reads or otherwise takes in content after it is published or shared.

6.7 Intranet Design with Open source Tools: DRUPAL, JOOMLA

DRUPAL is an open source content management platform powering millions of websites and applications. It's built, used, and supported by an active and diverse community of people around the world.

Drupal is Open Source

Drupal is open source software maintained and developed by a community of 630,000+ users and developers. It's distributed under the terms of the GNU General Public License

(or "GPL"), which means anyone is free to download it and share it with others. This open development model means that people are constantly working to make sure Drupal is a cutting-edge platform that supports the latest technologies that the Web has to offer. The Drupal project's principles encourage modularity, standards, collaboration, ease-of-use, and more.

Core modules

Drupal core includes optional modules that can be enabled by the administrator to extend the functionality of the core website.

The core Drupal distribution provides a number of features, including:

- Access statistics and logging
- Advanced search
- Blogs, books, comments, forums, and polls
- Caching and feature throttling for improved performance
- Descriptive URLs
- Multi-level menu system
- Multi-site support
- Multi-user content creation and editing
- RSS feed and feed aggregator
- Security and new release update notification
- User profiles
- Various access control restrictions (user roles, IP addresses, email)

Etc.

https://www.drupal.org

JOOMLA is an award-winning content management system (CMS), which enables you to build Web sites and powerful online applications. Many aspects, including its ease-of-use and extensibility have made Joomla the most popular Web site software available. Best of all, Joomla is an open source solution that is freely available to everyone.

Joomla is used all over the world to power Web sites of all shapes and sizes. For example:

- Corporate Web sites or portals
- Corporate intranets and extranets
- Online magazines, newspapers, and publications
- E-commerce and online reservations
- Government applications
- Small business Web sites
- Non-profit and organizational Web sites
- Community-based portals
- School and church Web sites
- Personal or family homepages

http://joomla.org

[Demonstration]

6.8 Tunneling Protocols: VPN

As a business grows, it might expand to multiple shops or offices across the country and around the world. To keep things running efficiently, the people working in those locations need a fast, secure and reliable way to share information across computer networks. In addition, traveling employees like salespeople need an equally secure and reliable way to connect to their business's computer network from remote locations.

One popular technology to accomplish these goals is a **VPN** (**virtual private network**). A VPN is a private network that uses a public network (usually the Internet) to connect remote sites or users together. The VPN uses "virtual" connections routed through the Internet from the business's private network to the remote site or employee. By using a VPN, businesses ensure security - anyone intercepting the encrypted data can't read it.

VPN was not the first technology to make remote connections. Several years ago, the most common way to connect computers between multiple offices was by using a **leased line**. Leased lines, such as ISDN (integrated services digital network, 128 Kbps), are private network connections that a telecommunications company could lease to its customers. Leased lines provided a company with a way to expand its private network beyond its immediate geographic area. These connections form a single **wide-area network** (WAN)

for the business. Though leased lines are reliable and secure, the leases are expensive, with costs rising as the distance between offices increases.

> A **virtual private network** (**VPN**) extends a private network across a public network, such as the Internet. It enables a computer to send and receive data across shared or public networks as if it is directly connected to the private network, while benefiting from the functionality, security and management policies of the private network. A VPN is created by establishing a virtual point-to-point connection through the use of dedicated connections, virtual tunneling protocols, or traffic encryptions.
>
> A virtual private network connection across the Internet is similar to a wide area network (WAN) link between sites. From a user perspective, the extended network resources are accessed in the same way as resources available within the private network. VPNs allow employees to securely access their company's intranet while traveling outside the office. Similarly, VPNs securely connect geographically separated offices of an organization, creating one cohesive network.

Today, the Internet is more accessible than ever before, and Internet service providers (ISPs) continue to develop faster and more reliable services at lower costs than leased lines. To take advantage of this, most businesses have replaced leased lines with new technologies that use Internet connections without sacrificing performance and security. Businesses started by establishing **intranets**, which are private internal networks designed for use only by company employees. Intranets enabled distant colleagues to work together through technologies such as desktop sharing. By adding a VPN, a business can extend all its intranet's resources to employees working from remote offices or their homes.

Analogy: Each LAN is an Island

Imagine that you live on an island in a huge ocean. There are thousands of other islands all around you, some very close and others farther away. The common means of travel between islands is via ferry. Traveling on the ferry means that you have almost no privacy: Other people can see everything you do.

Let's say that each island represents a private local area network (LAN) and the ocean is the Internet. Traveling by ferry is like connecting to a Web server or other device through the Internet. You have no control over the wires and routers that make up the Internet, just like you have no control over the other people on the ferry. This leaves you disposed to security issues if you're trying to connect two private networks using a public resource.

Continuing with the analogy, your island decides to build a bridge to another island so that people have an easier, more secure and direct way to travel between the two islands. It is expensive to build and maintain the bridge, even if the islands are close together. However, the need for a reliable, secure path is so great that you do it anyway. Your island would like to connect to yet another island that is much farther away, but decides that the costs are simply too much to bear.

This scenario represents having a leased line. The bridges (leased lines) are separate from the ocean (Internet), yet are able to connect the islands (LANs). Companies who choose this option do so because of the need for security and reliability in connecting their remote offices. However, if the offices are very far apart, the cost can be prohibitively high - just like trying to build a bridge that spans a great distance.

Using this analogy, suppose each inhabitant on your island has a small submarine. Let's assume that each submarine has these amazing properties:

- It's fast.
- It's easy to take with you wherever you go.
- It's able to completely hide you from any other boats or submarines.
- It's dependable.
- It costs little to add additional submarines to your fleet once you've purchased the first one.

Although they're traveling in the ocean along with other traffic, the people could travel between islands whenever they wanted to with privacy and security. That's essentially how a VPN works. Each remote member of your network can communicate in a secure and reliable manner using the Internet as the medium to connect to the private LAN. A VPN can grow to accommodate more users and different locations much more easily than a leased line. In fact, scalability is a major advantage that VPNs have over leased lines. Moreover, the distance doesn't matter, because VPNs can easily connect multiple geographic locations worldwide.

A well-designed VPN provides a business with the following benefits:

- Extended connections across multiple geographic locations without using a leased line
- Improved security for exchanging data

- Flexibility for remote offices and employees to use the business intranet over an existing Internet connection as if they're directly connected to the network
- Savings in time and expense for employees to commute if they work from virtual workplaces
- Improved productivity for remote employees

A business might not require all these benefits from its VPN, but it should demand the following essential VPN features:

- Security -- The VPN should protect data while it's traveling on the public network. If intruders attempt to capture the data, they should be unable to read or use it.
- Reliability -- Employees and remote offices should be able to connect to the VPN with no trouble at any time (unless hours are restricted), and the VPN should provide the same quality of connection for each user even when it is handling its maximum number of simultaneous connections.
- Scalability -- As a business grows, it should be able to extend its VPN services to handle that growth without replacing the VPN technology altogether.

While a VPN can be configured on generic computer equipment such as standard servers, most businesses opt for dedicated equipment optimized for the VPN and general network security. A small company might have all of its VPN equipment on site or, might outsource its VPN services to an enterprise service provider.

There is no standard that all VPNs follow in terms of their setup. When planning or extending a VPN, though, you should consider the following equipment:

- Network access server -- a NAS is responsible for setting up and maintaining each tunnel in a remote-access VPN.
- Firewall -- A **firewall** provides a strong barrier between your private network and the Internet. IT staff can set firewalls to restrict what type of traffic can pass through from the Internet onto a LAN, and on what TCP and UDP ports. Even without a VPN, a LAN should include a firewall to help protect against malicious Internet traffic.
- AAA Server -- The acronym stands for the server's three responsibilities: authentication, authorization and accounting. For each VPN connection, the AAA server confirms who you are (authentication), identifies what you're allowed to access over the connection (authorization) and tracks what you do while you're logged in (accounting).

One widely used standard for AAA servers is Remote Authentication Dial-in User Service (RADIUS). Despite its name, RADIUS isn't just for dial-up users. When a RADIUS server is part of a VPN, it handles authentication for all connections coming through the VPN's NAS.

Configure a VPN connection from a client computer

To set up a connection to a VPN, follow these steps:

1. On the computer that is running Windows XP, confirm that the connection to the Internet is correctly configured.
2. Click **Start**, and then click **Control Panel**.
3. In Control Panel, double-click **Network Connections**.
4. Click **Create a new connection**.
5. In the Network Connection Wizard, click **Next**.
6. Click **Connect to the network at my workplace**, and then click **Next**.
7. Click **Virtual Private Network connection**, and then click **Next**.
8. If you are prompted to, do one of the following:
    - If you use a dial-up connection to connect to the Internet, click **automatically dial this initial connection**, and then click your dial-up Internet connection from the list.
    - If you use a full-time connection such as a cable modem, click **Do not dial the initial connection**.
9. Click **Next**.
10. Type the name of your company or type a descriptive name for the connection, and then click **Next**.
11. Type the host name or the Internet Protocol (IP) address of the computer that you want to connect to, and then click**Next**.
12. Click **Anyone's use** if you want the connection to be available to anyone who logs on to the computer, or click **My use only** to make it available only when you log on to the computer, and then click **Next**.
13. Click to select the **Add a shortcut to this connection to my desktop** check box if you want to create a shortcut on the desktop, and then click **Finish**.
14. If you are prompted to connect, click **No**.
15. In the **Network Connections** window, right-click the new connection.
16. Click **Properties**, and then configure more options for the connection:

- If you are connecting to a domain, click the **Options** tab, and then click to select the **Include Windows logon domain** check box to specify whether to request Windows logon domain information before you try to connect.
- If you want the computer to redial the connection if the line is dropped, click the **Options** tab, and then click to select the **Redial if line is dropped** check box.

To use the connection, follow these steps:

1. Use one of the following methods:
   - Click **Start**, point to **Connect To**, and then click the new connection.
   - If you added a connection shortcut to the desktop, double-click the shortcut on the desktop.
2. If you are not currently connected to the Internet, Windows offers to connect to the Internet.
3. After your computer connects to the Internet, the VPN server prompts you for your user name and password. Type your user name and password, and then click **Connect**. Your network resources should be available to you in just like they are when you connect directly to the network.
4. To disconnect from the VPN, right-click the icon for the connection, and then click **Disconnect**.

[Refer the videos of VPN folder.]

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CHAPTER 7

7. Internet and Intranet Applications **6 hrs.**

7.1 General Applications: E-mail, WWW, Gopher, Online Systems

Email

[Assignment/ Self Study]

WWW

[Assignment/ Self Study]

Gopher

A system that pre-dates the World Wide Web for organizing and displaying files on Internet servers. A Gopher server presents its contents as a hierarchically structured list of files. With the ascendance of the Web, many gopher databases were converted to Web sites, which can be more easily accessed via Web search engines.

The **Gopher protocol** is a TCP/IP application layer protocol designed for distributing, searching, and retrieving documents over the Internet. The Gopher protocol was strongly oriented towards a menu-document design and presented an alternative to the World Wide Web in its early stages, but ultimately HTTP became the dominant protocol. The Gopher ecosystem is often regarded as the effective predecessor of the World Wide Web.

7.2 Multimedia and Digital Video/Audio Broadcasting: Video/Audio Conferencing, Internet Relay Chat (IRC)

Multimedia and Digital Video/Audio Broadcasting

Digital multimedia broadcasting (DMB) is a method of multicasting multimedia content to mobile and portable devices, such as cell phones, by satellite or terrestrial services, or a combination of the two. Some DMB-capable receiving devices can render content that is individualized to the location or subscriber.

Common examples of multimedia broadcast content include:

- Text and audio
- Text, audio, and still or animated graphics
- Audio and full-motion video
- Text, audio, and full-motion video
- Multiple, concurrent display areas, images, or programs

The most popular application of DMB is mobile television. Movies, video clips, music, RSS feeds, and text messages can also be transmitted. Most existing and proposed DMB services operate on a fee-based subscription basis, although advertising has been suggested as a revenue source.

> **Digital Multimedia Broadcasting** (**DMB**) is a digital radio transmission technology developed in South Korea as part of the national IT project for sending multimedia such as TV, radio and data casting to mobile devices such as mobile phones, laptops and GPS navigation systems. This technology, sometimes known as mobile TV, should not be confused with Digital Audio Broadcasting, which was developed as a research project for the European Union. DMB was developed in South Korea as the next generation digital technology to replace FM radio, but Prof. Dr. Gert Siegle and Dr. Hamed Amor at Robert Bosch GmbH in Germany laid the technological foundations. The world's first official mobile TV service started in South Korea in May 2005, although trials were available much earlier. It can operate via satellite (**S-DMB**) or terrestrial (**T-DMB**) transmission.

Video/Audio Conferencing

This is a very broad category of online tools, incorporating a range of options from free one-to-one audio conferencing all the way to more sophisticated and expensive tools such as ***Polycom***, which allow multiple sites with entire classes participating using video and audio.

1. Video and audio, or just audio connection between two computers communicating via the Internet.
    - Examples of free audio conferencing software: Gizmo, Skype (both cross platform) both enable users to speak to other Gizmo/Skype users free of charge (although users can also pay a fee and make calls to landlines using the computer). << View List on Wikipedia.org >>

- Examples of free video conferencing software: iVisit (cross platform), iChat (Mac only), NetMeeting (Windows only).
- Breeze can also be used for video conferencing (but Breeze is more than just a video/audio conferencing tool.

2. Transmitted to & received from any computer in any location that has Internet connection (broadband desirable for effective use). Teacher must have microphone, can have camera. Ideally end users have microphone (camera not essential) for synchronous communication.

3. Technology requirements for video/audio conferencing:
   - Computer with access (ideally broadband) to the Internet.
   - Browser.
   - Speakers to hear audio.
   - Microphone (to contribute audio).
   - Web camera to contribute video.

Why use video/audio conferencing?

Enables teacher or limited numbers of learners need to connect from different locations at the same time when only video and/or audio connection is needed. Examples: guest speaker at remote location can talk to local class; students in one class can engage in discussion with students at another location (such as a class in another country); when a student is unable to attend face-to-face class, s/he can connect to class via VOIP; students can take virtual field trips to remote locations.

Advantages video/audio conferencing

Note: Within the broad category of video/audio conferencing there are different types, each with their own advantages, so not all within the following list applies to each specific tool.

1. Free download of easy to use software that can be used via Internet to connect student, instructor, or guest speaker to class and enable both sides to see & hear.
2. Enables individual (usually limited to one connection) to participate in synchronous learning experiences from any location worldwide. Users can connect from home, work or

other location easily accessible to them.

3. Specifically useful for guest speaker who is far away from face-to-face class location, or student who cannot be in face-to-face class.
4. Enables students to take virtual field trips to remote locations (either just by viewing the video or engaging in an interactive lesson. This is especially an advantage to students who attend schools in isolated communities, but is an advantage to all students regardless of location or socio-economic factors.
5. Can be used to record *vodcast* or *podcast* and uploaded to course website.

Disadvantages of video/audio conferencing

Note: Within the broad category of video/audio conferencing there are different types, each with their own disadvantages, so not all within the following list applies to each specific tool.

1. Typically on free systems only one or a very limited number of users can connect to the host (instructor) computers at a time, so video/audio conferencing can be used only for individual access rather than as a larger scale tool and learning environment. However, newer systems such as Camfrog enable multi-user video conferencing.
2. Depending on the stability of the connection, users may be disconnected during the class and have to reconnect.
3. Difficult to see and hear people who are not close to the microphone/camera, especially when using one of the low-cost systems (such as iSight camera). Thus difficult to have multiple people at one site, sharing a computer to communicate with users at other sites.

Issues & problems related to video/audio conferencing

1. Works best with broadband connection, especially for video conferencing. Users report that after the initial fascination with the video component has worn off, they realize that they really only need to use the audio as this uses less bandwidth and results in higher quality audio than the video option. Because of the small video window and low quality, the video image is of limited use.
2. If used for users connecting to face-to-face class, it is important to have good quality speakers so that classroom-based students can hear the person who is calling in.
3. Students speaking from classroom must identify who they are before speaking.
4. Requires students connecting to class from remote site to be able to follow discussion relying just on audio or audio with low quality video (students report this being challenging,

especially for long lectures). This is also an accessibility issue.

Emerging issues and tips

1. More often than not, once users at each site know what other users look like, more often than not it is not necessary to use video -- the audio connection is sufficient (since the video quality isn't high and you can usually only see the person's face). The video is really only necessary when users want to demonstrate something or show something to remote users.
2. If a student is connecting to a class via audio connection, handouts and visual aids can be sent to him/her via email or made available on course website ahead of time. If the instructor writes on the board or there is some other visual or interaction that happens in class, the instructor can take a digital photo or digital video and upload this to the course website.

IRC

Short for ***I**nternet **R**elay **C**hat,* a *chat system* developed by Jarkko Oikarinen in Finland in the late 1980s. IRC has become very popular as more people get connected to the Internet because it enables people connected anywhere on the Internet to join in live discussions. Unlike older chat systems, IRC is not limited to just two participants.

To join an IRC discussion, you need an *IRC client* and Internet access. The IRC client is a program that runs on your computer and sends and receives messages to and from an IRC *server*. The IRC server, in turn, is responsible for making sure that all messages are broadcast to everyone participating in a discussion. There can be many discussions going on at once; each one is assigned a unique *channel*.

> **Internet Relay Chat** (**IRC**) is an application layer protocol that facilitates transfer of messages in the form of text. The chat process works on a client/server model of networking. IRC clients are computer programs that a user can install on their system. These clients are able to communicate with chat servers to transfer messages to other clients. It is mainly designed for group communication in discussion forums, called *channels*, but also allows one-to-one communication via private message as well as chat and data transfer, including file sharing.
>
> Client software is available for every major operating system that supports Internet access. As of April 2011, the top 100 IRC networks served more than half a million users at a time, with hundreds of thousands of channels operating on a total of roughly 1,500 servers out of roughly 3,200 servers worldwide.
>
> Over the past decade IRC usage has been declining: since 2003 it has lost 60% of its users (from 1 million to about 400,000 in 2014) and half of its channels (from half a million in 2003).

Free IRC Clients for Windows

1. mIRC
2. X-Chat
3. HydraIRC
4. KVIrc
5. Nettalk
6. Quassel
7. ThrashIRC

7.3 Broadband Communications, xDSL and Cable Internet

Broadband Communications

The vast improvements in corporate and access networks over the last decade have been the driving force behind the global economy. The Internet has advanced robust demand for broadband services, leading to an explosive growth in Internet Protocol (IP) data and over-the-top video traffic and putting enormous pressure on carriers to upgrade their existing networks. The rapid decline in the cost of fiber optics and Ethernet equipment has made them an attractive option for access loop deployment. The digitization of the world continues to deepen as more and more images, sounds, and videos convert to digital data that can be stored, shared, manipulated, and transmitted.

"Internet access that is always on and faster than the traditional dial-up access" - US National Broadband Plan

The convergence of these factors is leading to a fundamental paradigm shift in the communications industry - a shift that will ultimately lead to widespread adoption of a new optical IP Ethernet architecture that combines the best of fiber optic and Ethernet technologies. This revolution will fundamentally change the way people manage, use, and share data, by driving the interaction between all digital devices possible, be it a PC, a cell phone, a PDA, or an entertainment device. This architecture is poised to become the dominant means of delivering bundled data, video, and voice services on a single platform.

The term ***broadband*** refers to the wide bandwidth characteristics of a transmission medium and its ability to transport multiple signals and traffic types simultaneously. The

medium can be coaxial cable, optical fiber, twisted pair, DSL local telephone networks or wireless. In contrast, baseband describes a communication system in which information is transported across a single channel.

In general, broadband refers to telecommunication in which a wide band of frequencies is available to transmit information. Because a wide band of frequencies is available, information can be multiplexed and sent on many different frequencies or channels within the band concurrently, allowing more information to be transmitted in a given amount of time (much as more lanes on a highway allow more cars to travel on it at the same time). Related terms are *wideband* (a synonym), baseband (a one-channel band), and narrowband (sometimes meaning just wide enough to carry voice, or simply "not broadband," and sometimes meaning specifically between 50 cps (characters per second) and 64 Kpbs).

It is generally agreed that Digital Subscriber Line (DSL) and cable TV are broadband services in the downstream direction.

Broadband refers to a communication bandwidth of at least 256 kbit/s. Each channel is 4 MHz wide and it uses an extensive range of frequencies to effortlessly relay and receive data between networks. In telecommunications, a **broadband** signaling method is one that handles a wide band of frequencies.

Broadband policy in Nepal

The Broadband Policy is considered to be key to development of information and communication technology and implementation of e-governance. It is expected to make service delivery easy and effective in remote areas by expanding wireless broadband internet as other means of communication are difficult because of rough terrain.

The Nepal Telecommunications Authority is finalizing the much-awaited Broadband Policy and it needs to be endorsed by the government.

The term broadband has not yet been defined in the context of Nepal even though it has been 15 years since the Internet became available in the country.

The broadband policy is crucial for the overall development of the information and communication technology sector. According to the draft policy, broadband will identify

the minimum speed in Kbps — uplink and downlink — wherever the service is offered. It will also guarantee the quality of service — throughout on a shared or dedicated basis — on services that a service provider offers. It will guarantee the quality of service -- throughput on a shared or dedicated basis -- on services that a service provider offers. If a tele-centre, for example, claims to have broadband Internet, then it should satisfy the criteria defined by the Broadband Policy.

At present, broadband has nothing to do with speed or quality. Currently local Internet service providers (ISPs) are advertising their services as broadband Internet without knowing its standards.

In India, the term is defined as "an always-on data connection that is able to support interactive services including Internet access and has the capability of the minimum access and has the capability of the minimum download speed of 256 Kbps to an individual subscriber.

Broadband needs to be considered a basic national infrastructure as it will fundamentally reshape the world in the 21st century and change the way services are delivered — from e-health to e-education to e-commerce –– Nepal Telecommunications Authority said, adding that the soon to be formed broadband policy will provide a clear headway for the development of the broadband sector in the country.

This FY 071/72 will have all district headquarters connected with optical fiber broadband solution as the GoN plans to pull the fiber thru out the country. The lack of optical fiber connection in the mid-hilly regions connected with (hilly) highway has left the hilly and mountains terrain of the country with poor Internet connectivity whereas the Terai belt is all-well connected with the fiber.

The GoN has proposed an ambitious budget of 4.13 billion rupees for the development of the Information and Communication Sector in the country. This investment is the largest ever made in this field in the Nepalese history from the Government side.

As of today, the state owned telecom Nepal Telecom (NT) has reached its telephony and data service to all the districts while the private company Ncell has its loyal customers in most of the remote part of the country.

The power of broadband to increase the economy and have positive impacts on the Gross Domestic Product (GDP) of the country – is all what the GoN is keen on about with this broadband policy.

The Government is also planning to merge the state owned television station – Nepal Television (NTV) and radio station – Radio Nepal so as to expand the information and communication reach of the government. The merger of these two will result in a new Public Broadcasting Service (PBS) in Nepal.

xDSL

Digital subscriber line (**DSL**; originally **digital subscriber loop**) is a family of technologies that provide internet access by transmitting digital data using a local telephone network which uses the Public switched telephone network. In telecommunications marketing, the term DSL is widely understood to mean asymmetric digital subscriber line (ADSL), the most commonly installed DSL technology. DSL service is delivered simultaneously with wired telephone service on the same telephone line. This is possible because DSL uses higher frequency bands for data. On the customer premises, a DSL filter on each non-DSL outlet blocks any high frequency interference, to enable simultaneous use of the voice and DSL services.

DSL technologies use sophisticated modulation schemes to pack data onto copper wires. They are sometimes referred to as last-mile technologies because they are used only for connections from a telephone switching station to a home or office, not between switching stations.

xDSL offers much higher speeds - up to 32 Mbps for upstream traffic, and from 32 Kbps to over 1 Mbps for downstream traffic.

The bit rate of consumer DSL services typically ranges from 256 kbit/s to over 100 Mbit/s in the direction to the customer (downstream), depending on DSL technology, line conditions, and service-level implementation. Bit rates of 1 Gbit/s have been reached in trials. In ADSL, the data throughput in the upstream direction, (the direction to the service

provider) is lower, hence the designation of *asymmetric* service. In symmetric digital subscriber line (SDSL) services, the downstream and upstream data rates are equal. Researchers at Bell Labs have reached broadband speeds of 10Gbps, while delivering 1Gbit/s symmetrical ultra-broadband access services using traditional copper telephone lines. These speeds can be achieved with existing telephone lines and can be used to deliver broadband where fiber optic cables can't be installed to the premise.

Cable Internet

Cable Internet service is a type of broadband connection that transmits data over a cable television network. Typically faster than DSL and cheaper than fiber-optic, a cable Internet connection offers a great balance of speed and affordability.

Broadband cable Internet access requires a cable modem at the customer's premises and a cable modem termination system at a cable operator facility, typically a cable television head end. The two are connected via coaxial cable or a Hybrid Fiber Coaxial (HFC) plant. While access networks are sometimes referred to as *last-mile* technologies, cable Internet systems can typically operate where the distance between the modem and the termination system is up to 160 kilometers (99 mi).

Downstream, the direction toward the user, bit rates can be as much as 400 Mbit/s for business connections, and 250 Mbit/s for residential service in some countries. Upstream traffic, originating at the user, ranges from 384 kbit/s to more than 20 Mbit/s. One downstream channel can handle hundreds of cable modems.

How Cable Internet Works

Unlike dial-up and DSL, which transmit data over a phone line, cable Internet service uses the cable TV infrastructure to transmit data. Cable Internet users have a special cable modem, provided by the cable Internet companies themselves that use a slice of the available bandwidth of the connection to download and upload information. Just like how a DSL connection does not tie up its phone line, a cable Internet connection does not affect the ability to watch TV throughout the house.

Benefits of Cable High-Speed

Speed – Cable connections are incredibly quick, with some cable Internet providers able to deliver download speeds as fast as 100 Mbps

Consistency – While the speed of a DSL connection is based on how close your house is to the phone company, a cable connection will have a consistent speed no matter how far away the cable company is

No Landline Required – A cable connection does not require a phone line, which can help save you money

Price – Cable high-speed service typically delivers the lowest cost per Mbps in a given area

Always On – Unlike a dial-up connection, a cable connection is constantly connected and ready whenever you are

7.4 VoIP, FoIP and IP Interconnection

Voice over Internet Protocol is a category of hardware and software that enables people to use the Internet as the transmission medium for telephone calls by sending voice data in packets using IP rather than by traditional circuit transmissions of the PSTN.

One advantage of VoIP is that the telephone calls over the Internet do not incur a surcharge beyond what the user is paying for Internet access, much in the same way that the user doesn't pay for sending individual emails over the Internet.

There are many Internet telephony applications available. Some, like CoolTalk and NetMeeting, come bundled with popular Web browsers. Others are stand-alone products. VoIP is also referred to as *Internet telephony*, *IP telephony, or Voice over the Internet (VOI).*

VoIP and IP telephony are becoming increasingly popular with large corporations and consumers alike. For many people, Internet Protocol (IP) is more than just a way to transport data, it's also a tool that simplifies and streamlines a wide range of business applications. Telephony is the most obvious example. VoIP—or voice over IP—is also the foundation for more advanced unified communications applications—including Web and video conferencing—that can transform the way you do business.

What is VoIP: Useful Terms

- **VoIP** refers to a way to carry phone calls over an IP data network, whether on the Internet or your own internal network. A primary attraction of VoIP is its ability to help reduce expenses because telephone calls travel over the data network rather than the phone company's network.
- **IP telephony** encompasses the full suite of VoIP enabled services including the interconnection of phones for communications; related services such as billing and dialing plans; and basic features such as conferencing, transfer, forward, and hold.
- **IP communications** includes business applications that enhance communications to enable features such as unified messaging, integrated contact centers, and rich-media conferencing with voice, data, and video.

7.5 Datacenters and Data warehousing, packet clearing house

A **data center** is a facility used to house computer systems and associated components, such as telecommunications and storage systems. It generally includes redundant or backup power supplies, redundant data communications connections, environmental controls (e.g., air conditioning, fire suppression) and various security devices. Large data centers are industrial scale operations using, as much electricity as a small town and sometimes are a significant source of air pollution in the form of diesel exhaust. Capabilities exist to install modern retrofit devices on older diesel generators, including those found in data centers, to reduce emissions.

A **data warehouse** is a relational database that is designed for query and analysis rather than for transaction processing. It usually contains historical data derived from transaction data, but it can include data from other sources. It separates analysis workload from transaction workload and enables an organization to consolidate data from several sources.

In addition to a relational database, a data warehouse environment includes an extraction, transportation, transformation, and loading (ETL) solution, an online analytical processing (OLAP) engine, client analysis tools, and other applications that manage the process of gathering data and delivering it to business users.

A data warehouse is a subject-oriented, integrated, time-variant and non-volatile collection of data in support of management's decision-making process.

Subject-Oriented: A data warehouse can be used to analyze a particular subject area. For example, "sales" can be a particular subject.

Integrated: A data warehouse integrates data from multiple data sources. For example, source A and source B may have different ways of identifying a product, but in a data warehouse, there will be only a single way of identifying a product.

Time-Variant: Historical data is kept in a data warehouse. For example, one can retrieve data from 3 months, 6 months, 12 months, or even older data from a data warehouse. This contrasts with a transactions system, where often only the most recent data is kept. For example, a transaction system may hold the most recent address of a customer, where a data warehouse can hold all addresses associated with a customer.

Non-volatile: Once data is in the data warehouse, it will not change. So, historical data in a data warehouse should never be altered.

Packet Clearing House (PCH) is a non-profit research organization dedicated to evaluating the operations of Internet traffic exchange, routing economics, and global network development. Since its foundation in 1994, the institute has become one of the

leaders in the advocacy for neutral independent network interconnection. PCH also provides route-servers for main exchange points around the world. The Packet Clearing House is composed of a Board of Directors, Technologists, Staff and Volunteers who work together to handle the institute's projects.

Purpose

PCH is primarily focused on providing educational resources regarding Internet topology and economics, routing and technology, and traffic exchange policy, through classes, meetings, and distribution of educational materials. It also conducts research on technology, economic, and policy issues in relation to Internet traffic exchange. **The Internet Routing Topology Archive** is the longest running research project of the institute; it began in 1997. The archive is a database of Internet topology measurements. In terms of policy, PCH helps policy developers understand the operations of the internet and explains how it affects the economic development and the living standards of people worldwide.

7.6 Unified Messaging Systems

Unified messaging is the integration of different electronic messaging and communications media (e-mail, SMS, fax, voicemail, video messaging, etc.) technologies into a single interface, accessible from a variety of different devices. While traditional communications systems delivered messages into several different types of stores such as voicemail systems, e-mail servers, and stand-alone fax machines, with Unified Messaging all types of messages are stored in one system. Voicemail messages, for example, can be delivered directly into the user's inbox and played either through a headset or the computer's speaker. This simplifies the user's experience (only one place to check for messages) and can offer new options for workflow such as appending notes or documents to forwarded voicemails.

A unified messaging system allows end users to access several messaging applications through a single interface. UMS is generally a comprehensive software solution that is hosted and delivered through an enterprise-class server along with network connectivity and supporting devices. UMS fetches stores and delivers messages from all the configured

services, which the user can access from various computing interfaces such as a computer or Smartphone.

7.7 Fundamental of ecommerce

The buying and selling of products and services by businesses and consumers through an electronic medium, without using any paper documents. E-commerce is widely considered the buying and selling of products over the Internet, but any transaction that is completed solely through electronic measures can be considered e-commerce. E-commerce is subdivided into three categories: business to business or B2B (Cisco), business to consumer or B2C (Amazon), and consumer-to-consumer or C2C (eBay).

"As the Internet continues to grow, so does e-commerce because more stores offer online shopping to their customers."

Fundamentals that you can put in place to enhance an existing online store or plan a new one...

• **The most important thing online is the user experience**. It can be argued that everything else is secondary. Websites that frustrate will not endear your brand to prospective customers. Try to create an online experience where users can **easily find and digest** the information they need in order to precede to the checkout.

• **Solid 'on-site search' functionality is vital**. You need good-quality metadata to make it work properly. One E-consultancy study showed that *half of all site searches returned no results even where products were available*.

• **Well-defined information architecture and intuitive navigation is essential**. Studies have shown that most people are 'cognitive misers'. In plain English: people don't like to think. Keep this in mind when wire framing your site.

• **Clearly label categories and pages**. Talk in *the same language* as your users. This language is the language of search. People will type in search queries that make sense to them – you need to **mirror these search queries** on your website (*keywords in titles, body text, internal links, etc*). Use keyword suggestion tools to figure out which terms are most-searched for. You should define a keyword strategy very early on – figure out the top 50 keywords/phrases that you want to rank well on.

• **Trust and credibility need to be reinforced, particularly in key purchase areas, and especially for new or unknown brands**. This means *testimonials, customer feedback, and press cuttings*. It also means highly visible contact details (*telephone / email*) and online customer support options (*FAQ / help / delivery options*).

E-commerce refers to the purchase and sale of goods and/or services via electronic channels, such as the Internet. Online retail is convenient due to its 24-hour availability, global reach and ease of customer service.

• **Prioritize the key information users look for during the purchase decision-making process**. *Price, features, delivery options* and the *buy now button* all need to be placed above the fold.

• **Minimize distractions – keep the user focused on the purchase or conversion goal**. This means *no flashing ads* above the fold, among other things. It means up-selling and cross-selling *at appropriate times*, and not too early (to avoid confusing the user before they've fully bought into the purchase decision). Yes to white space and big fonts.

• **Good copy**. Copywriting is just as important online as it is offline. Be persuasive and add value where you can. Talk to the user as an individual. Think about what you would want to see, in order to precede to the checkout. Use an active voice, not a passive one. Avoid jargon.

• **Images**. Pictures might be very important to your customers, to help them evaluate products. In some sectors, images aren't needed whatsoever. They are absolutely crucial in others. Optimize images for Google when you upload them. And compress them! Keep an eye on page weight – slow loading times can annoy and frustrate users.

• **Service the pre-purchase consumer**. The e-commerce store is often a place for research (*I almost always look at Amazon recommendations when buying any kind of product*). Most people research products and services online prior to starting out on their purchase journey (in a separate session). When in pre-purchase mode users looks for **comparison tools** to help them weigh up the options? If your competitors have better **feature filtering tools** then users may prefer to use their website. *'Watchlists'* are a good idea too – encourage users to 'save items to

watchlist', to start a relationship with them (*a simple register user account may be needed here, but don't ask for much more than an email address at this point*).

• **No alarms and no surprises**. Always let the user know what to expect, especially when they've started to purchase.

• **Highly visible support options**. This is worth mentioning again in case you missed it earlier. It means *prominently displayed telephone numbers, emails, online customer service tools, delivery tracking*, and so on. This is **absolutely vital**, especially to first-time customers and non-savvy Internet users, who may have a lingering mistrust of the Internet.

7.8 Concept of Grid and Cloud Computing

Cloud computing

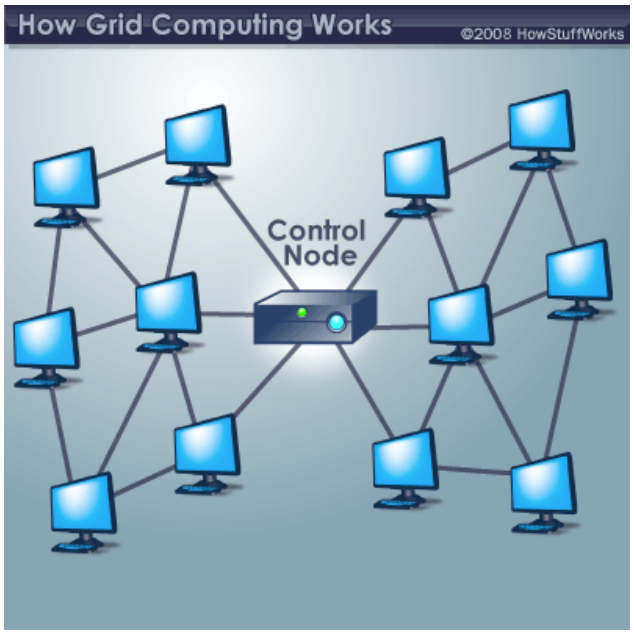
Cloud computing is the delivery of computing as a service rather than a product, whereby shared resources, software, and information are provided to computers and other devices as a utility (like the electricity grid) over a network (typically the Internet). Clouds can be classified as public, private or hybrid.

With cloud computing, companies can scale up to massive capacities in an instant without having to invest in new infrastructure, train new personnel, or license new software. Cloud computing is of particular benefit to small and medium-sized businesses who wish to completely outsource their data-center infrastructure, or large companies who wish to get peak load capacity without incurring the higher cost of building larger data centers internally. In both instances, service consumers use what they need on the Internet and pay only for what they use.

The service consumer no longer has to be at a PC, use an application from the PC, or purchase a specific version that's configured for smartphones, PDAs, and other devices. The consumer does not own the infrastructure, software, or platform in the cloud. He has lower upfront costs, capital expenses, and operating expenses. He does not care about how servers and networks are maintained in the cloud. The consumer can access multiple servers anywhere on the globe without knowing which ones and where they are located.

Grid computing

Grid computing is the collection of computer resources from multiple locations to reach a common goal. The grid can be thought of as a distributed system with non-interactive workloads that involve a large number of files. Grid computing is distinguished from conventional high performance computing systems such as cluster computing in that grids tend to be more heterogeneous and geographically dispersed (thus not physically coupled). Although a single grid can be dedicated to a particular application, commonly a grid is used for a variety of purposes. Grids are often constructed with general-purpose grid middleware software libraries.



Cloud computing evolves from grid computing and provides on-demand resource provisioning. Grid computing may or may not be in the cloud depending on what types of users are using it. If the users are systems administrators and integrators, they care how things are maintained in the cloud. They upgrade, install, and virtualize servers and applications. If the users are consumers, they do not care how things are run in the system.

Grid computing requires the use of software that can divide and farm out pieces of a program as one large system image to several thousand computers. One concern about grid is that if one piece of the software on a node fails, other pieces of the software on other nodes may fail. This is alleviated if that component has a failover component on another node, but problems can still arise if components rely on other pieces of software to

accomplish one or more grid computing tasks. Large system images and associated hardware to operate and maintain them can contribute to large capital and operating expenses.

Similarities and differences

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.

Both computing types involve multi tenancy and multitask, meaning that many customers can perform different tasks, accessing a single or multiple application instances. Sharing resources among a large pool of users assists in reducing infrastructure costs and peak load capacity. Cloud and grid computing provide service-level agreements for guaranteed uptime availability of, say, 99.99 percent. If the service slides below the level of the guaranteed uptime service, the consumer will get service credit for receiving data late.

> The Amazon S3 provides a Web services interface for the storage and retrieval of data in the cloud. Setting a maximum limits the number of objects you can store in S3. You can store an object as small as 1 byte and as large as 5 GB or even several terabytes. S3 uses the concept of buckets as containers for each storage location of your objects. The data is stored securely using the same data storage infrastructure that Amazon uses for its e-commerce Web sites.

While the storage computing in the grid is well suited for data-intensive storage, it is not economically suited for storing objects as small as 1 byte. In a data grid, the amounts of distributed data must be large for maximum benefit.

-	**Grid computing**	**Cloud computing**
What?	Grids enable access to **shared** computing power and storage capacity from your desktop	Clouds enable access to **leased** computing power and storage capacity from your desktop
Who	Research institutes and universities federate	Large individual companies e.g. Amazon and

provides the service?	their services around the world through projects such as ***EGI-InSPIRE*** and the European Grid Infrastructure.	Microsoft and at a smaller scale, institutes and organizations deploying open source software such as Open Slate, Eucalyptus and Open Nebula.
Who uses the service?	Research collaborations, called "Virtual Organizations", which bring together researchers around the world working in the same field.	Small to medium commercial businesses or researchers with generic IT needs
Who pays for the service?	Governments - providers and users are usually publicly funded research organizations, for example through National Grid Initiatives.	The cloud provider pays for the computing resources; the user pays to use them
Where are the computing resources?	In computing centers distributed across different sites, countries and continents.	The cloud providers private data centers which are often centralized in a few locations with excellent network connections and cheap electrical power.
Why use them?	- You don`t need to buy or maintain your own large computer center - You can complete more work more quickly and tackle more difficult problems. - You can share data with your distributed team in a secure way.	- You don`t need to buy or maintain your own personal computer center - You can quickly access extra resources during peak work periods
What are they useful for?	Grids were designed to handle large sets of limited duration jobs that produce or use large quantities of data	Clouds best support long term services and longer running jobs (E.g. facebook.com)
How do they work?	Grids are an **open source** technology. Resource users and providers alike can understand and contribute to the management of their grid	Clouds are a **proprietary** technology. Only the resource provider knows exactly how their cloud manages data, job queues, security requirements and so on.
Benefits?	- **Collaboration:** grid offers a federated platform for distributed and collective work. - **Ownership :** resource providers maintain ownership of the resources they contribute to	- **Flexibility:** users can quickly outsource peaks of activity without long term commitment - **Reliability:** provider has financial

	the grid - **Transparency:** the technologies used are open source, encouraging trust and transparency. - **Flexibility:** grids are located at multiple sites, reducing the risk in case of a failure at one site that removes significant resources from the infrastructure.	incentive to guarantee service availability (Amazon, for example, can provide user rebates if availability drops below 99.9%) - **Ease of use:** relatively quick and easy for non-expert users to get started but setting up sophisticated virtual machines to support complex applications is more difficult.
Drawbacks?	- **Reliability:** grids rely on distributed services maintained by distributed staff, often resulting in inconsistency in reliability across individual sites, although the service itself is always available. - **Complexity:** grids are complicated to build and use, and currently users require some level of expertise. - **Commercial:** grids are generally only available for not-for-profit work, and for proof of concept in the commercial sphere	- **Generality:** clouds do not offer many of the specific high-level services currently provided by grid technology. - **Security:** users with sensitive data may be reluctant to entrust it to external providers or to providers outside their borders. - **Opacity:** the technologies used to guarantee reliability and safety of cloud operations is not made public. - **Rigidity:** the cloud is generally located at a single site, which increases risk of complete cloud failure.
When?	The concept of grids was proposed in 1995. The Open science grid (OSG) started in 1995 The EDG (European Data Grid) project began in 2001.	In the late 1990`s Oracle and EMC offered early private cloud solutions. However the term cloud computing didn't gain prominence until 2007.

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