

THE INTERNET

The Internet, sometimes called simply "the Net," is a worldwide system of computer networks - a network of networks in which users at any one computer can, if they have permission, get information from any other computer (and sometimes talk directly to users at other computers). The Internet is a worldwide collection of networks linked together.

Accessing the internet

You should have the following to effectively use the services of internet:

1. NIC Network Interface Card: enables the computer to connect and be able to communicate.
2. Internet Service Provider (ISP) plan: is a company that supplies connections to the Internet, usually for a monthly fee.
3. A computer or any other device that a user will manipulate to use the service of internet.
4. An Operating System: required to configure the machine to accept all standards of using the internet by itself and other computers connected.
5. Modem: used to convert incoming signals into acceptable format for the computer to use.
6. Browser: used to access pages on the internet. Examples include – Internet Explorer, Mozilla Firefox, Netscape navigator, e.t.c.
7. Other devices include; routers, radio receivers, e.t.c.

Services of the internet

The World Wide Web is one of the most popular services available on the Internet. Other widely used Internet services include e-mail, FTP, newsgroups, message boards, mailing lists, chat rooms, instant messaging, Internet telephony, and videoconferencing.

1. **The World Wide Web:** also called the Web consists of a worldwide collection of electronic documents. Each of these documents on the Web is called a Web page.

A Web page can contain text, graphics, animations, audio, and video (i.e., multimedia elements), as well as built-in connections, called hyperlinks, to other documents.

2. **E-mail:** is the transmission of messages via a computer network such as a local area network or the Internet.
3. **FTP (File Transfer Protocol):** is an Internet standard that allows users to upload and download files with other computers.
4. **Newsgroups:** also called a discussion group, is an online area where users conduct written discussions about a particular subject.
5. **Message boards:** or discussion board is a Web-based type of discussion group that does not require a newsreader program.
6. **Mailing lists:** is a group of e-mail names and address given a single name. When a message is sent to a mailing list, every person on the list will receive a copy of the message.
7. **Chat rooms:** is a location on an Internet server that permits users to chat with each other by typing lines of text on the computer.

8. **Instant messaging:** is a real-time communications service that notifies a user when one or more people are online and then allows the user to exchange messages or files with them.
9. **Internet telephony:** sometimes called Voice over IP (VoIP), is a Web-based telephone service that allows a user to talk to others for just the cost of the Internet connection.
10. **Videoconferencing:** is a meeting between two or more geographically separated people who use a network or the Internet to transmit audio and video data. A videoconference conducted over the Internet, using Web browsers and Web servers to deliver the service, is called a Web conference.

A videoconference allows participants to collaborate as if they were in the same room. Videoconferencing software along with a microphone, speakers, and a digital video camera attached to the computer are required to participate in a videoconference.

Advantages of using the internet

People have different reasons for connecting to the Internet, which include:

1. It allows access to a wealth of information, such as news, weather reports, and airline schedules. It provides information at various levels of study. Everything from scholarly articles to ones directed at children. It provides information on almost every subject imaginable for example, history of a chair
2. It enables one to download files, listen to music, and watch movies free of charge.
3. Access sources of entertainment and leisure, such as online games, magazines, and vacation planning guides.

4. It has powerful search engines that enable users locate specific data in a short time.
5. It provides the ability for a user to do research from your home versus research libraries.
6. It provides message boards where people can discuss ideas on any topic. Ability to get wide range of opinions. People can find others that have a similar interest in whatever they are interested in.
7. The internet provides the ability of e-mails. Free mail service to anyone in the country. Therefore, communication is made simple and cheaper for a user. Platform for products like SKYPE, which allow for holding a video conference with anyone in the world who also has access.
8. Friendships and love connections have been made over the internet by people involved in love/passion over similar interests.
9. It enables one to shop for goods and services online i.e. *e-commerce*. One can buy a car from Japan without necessarily travelling. Electronic commerce (e-commerce) is a financial business transaction that occurs over an electronic network, such as the Internet. Online shopping and banking are two popular types of e-commerce that uses either electronic money (e-money) or electric data interchange (EDI).
 - ✓ E-money is a means of paying for goods and services over the Internet.
 - ✓ EDI is a set of standards that control the transfer of business data and information among computers both within and among companies.

E-commerce businesses can be grouped into three basic models:

- ✓ Business-to-consumer (B2C) e-commerce consists of the sale of goods to the general public.
- ✓ Consumer-to-consumer (C2C) e-commerce occurs when one consumer sells directly to another, such as in an online auction.
- ✓ Business-to-business (B2B) e-commerce consists of businesses providing goods and services to other businesses.

Advantages of e-commerce include

- a) Transactions can occur instantaneously and globally, thus save time for participants on both ends.
- b) Transactions can occur 24 hours per day.
- c) Businesses have access to millions of people with Internet connections.
- d) Businesses have the ability to gather customer information, analyze it, and react if appropriate.
- e) Information can be changed and be available quickly.
- f) Customers can compare prices easily.
- g) Feedback can be immediate.
- h) Manufacturers can buy and sell directly, avoiding the cost of the middleman.
- i) Distribution costs for information is reduced or eliminated.

Disadvantages of using the internet

1. There is a lot of wrong information on the internet. Anyone can post anything, and much of it is garbage.
2. There are predators that hang out on the internet waiting to get unsuspecting people in dangerous situations.
3. Some people are getting addicted to the internet and thus causing problems with their interactions of friends and loved ones.
4. Pornography that can get in the hands of young children too easily.
5. Easy to waste a lot of time on the internet. You can start surfing, and then realize far more time has passed than you realized. Internet and television together of added to the more sedentary lifestyles of people which further exacerbate the obesity problem.
6. Internet has a lot of "cheater" sites. People can buy essays and pass them off as their own far more easily than they used to be able to do.
7. There are a lot of unscrupulous businesses that have sprung up on the internet to take advantage of people.
8. Hackers can create viruses that can get into your personal computer and ruin valuable data.
9. Hackers can use the internet for identity theft.
10. It can be quite depressing to be on the internet and realize just how uneducated so many people have become in today's society.

The WWW

The World Wide Web (WWW), also called the Web, consists of a worldwide collection of electronic documents. Each of these documents on the Web is called a Web page. The WWW emerged in the early 1990s, but has grown fast to become the most widely used service on the Internet. A Web page can contain text, graphics, animations, audio, and video (i.e., multimedia elements), as well as built-in connections, called hyperlinks, to other documents. A Web site is a collection of related Web pages. A home page is the starting page or a table of contents for a Web site, and normally has a name called index.htm or index.html.

A Web browser is a software program used to access and view Web pages. Examples of web browsers include:

- | | | |
|----------------------|--------------|----------------|
| a) Internet Explorer | f) Konqueror | n) NetPositive |
| b) Mozilla Firefox | g) Arora | o) QNX Voyager |
| c) Opera | h) Dillo | p) Planetweb |
| d) Safari | i) K-Meleon | q) Netscape |
| e) Google Chrome | j) Lynx | r) Lunascape |
| | k) Lobo | s) Flock |
| | l) Kazexhase | |
| | m) Amaya | |

Each Web page has a unique address, called a Uniform Resource Locator (URL), which tells the browser where to locate the document. A URL consists of a protocol, a *domain name*, and *sometimes the path to a specific* Web page or location on a Web page.

Types of web sites

1. **Affiliate:** A site, typically few in pages, whose purpose is to sell a third party's product. The seller receives a commission for facilitating the sale.
2. **Affiliate Agency:** Enabled portal that renders not only its custom CMS but also syndicated content from other content providers for an agreed fee. There are usually three relationship tiers. Affiliate Agencies
3. **Archive site:** Used to preserve valuable electronic content threatened with extinction. Two examples are: Internet Archive, which since 1996 has preserved billions of old (and new) web pages; and Google Groups, which in early 2005 was archiving over 845,000,000 messages posted to Usenet news/discussion groups.
4. **Attack site:** A site created specifically to attack visitors computers on their first visit to a website by downloading a file (usually a trojan horse).

These websites rely on unsuspecting users with poor anti-virus protection in their computers.

5. **Blog (web log):** Sites generally used to post online diaries which may include discussion forums (e.g., blogger, Xanga). Many bloggers use blogs like an editorial section of a newspaper to express their ideas on anything ranging from politics to religion to video games to parenting, along with anything in between. Some bloggers are professional bloggers and they are paid to blog about a certain subject, and they are usually found on news sites.
6. **Brand building site:** A site with the purpose of creating an experience of a brand online. These sites usually do not sell

anything, but focus on building the brand. Brand building sites are most common for low-value, high-volume fast moving consumer goods (FMCG).

7. **Celebrity website:** A website whose information revolves around a celebrity. This sites can be official (endorsed by the celebrity) or fan made (run by his/her fan, fans, without implicit endorsement).
8. **Click-to-donate site:** A website that allows the visitor to donate to charity simply by clicking on a button or answering a question correctly. An advertiser usually donates to the charity for each correct answer generated.
9. **Community site:** A site where persons with similar interests communicate with each other, usually by chat or message boards.
10. **Content site:** Sites whose business is the creation and distribution of original content
11. **Corporate website:** Used to provide background information about a business, organization, or service.
12. **Dating website:** A site where users can find other single people looking for long range relationships, dating, or just friends.
13. **Electronic commerce (e-commerce) site:** A site offering goods and services for online sale and enabling online transactions for such sales.
14. **Forum website:** A site where people discuss various topics.
15. **Gallery Website:** A website designed specifically for use as a Gallery, these may be an art gallery or photo gallery and of commercial or non-commercial nature.

16. **Government Site:** A website made by the local, state, department or national government of a country. Usually these sites also operate websites that are intended to inform tourists or support tourism.
17. **Gripe site:** A site devoted to the criticism of a person, place, corporation, government, or institution.
18. **Gaming website and Gambling website:** A site that lets users play online games. Some enable people to gamble online.
19. **Humor site:** Satirizes parodies or otherwise exists solely to amuse.
20. **Information site:** Most websites could fit in this type of website to some extent many of them are not necessarily for commercial purposes
21. **Media sharing site:** A site that enables users to upload and view media such as pictures, music, and videos
22. **Mirror site:** A website that is the replication of another website. This type of websites is used as a response to spikes in user visitors.

Mirror sites are most commonly used to provide multiple sources of the same information, and are of particular value as a way of providing reliable access to large downloads.

23. **Microblog site:** A short and simple form of blogging. Micro blogs are limited to certain amounts of characters and works similar to a status update on Face book
24. **News site:** Similar to information site, but dedicated to dispensing news, politics, and commentary.

25. **Personal website:** Websites about an individual or a small group (such as a family) that contains information or any content that the individual wishes to include.

Many personal homepages are rare, thanks to the modern era of social networking sites such as Myspace, but some are still used for at home businesses. This website is different from a Celebrity website, which can be very expensive and run by a publicist or agency.

26. **Phishing site:** A website created to fraudulently acquire sensitive information, such as passwords and credit card details, by masquerading as a trustworthy person or business (such as Social Security Administration, PayPal) in an electronic communication (see Phishing).

27. **p2p/Torrents website:** Websites that index torrent files. This type of website is different from a Bit torrent client which is usually stand alone software.

28. **Political site:** A site on which people may voice political views, show political humor, campaigning for elections, or show information about a certain political party or ideology.

29. **Porn site:** A site that shows sexually plain content for enjoyment and relaxation. They can be similar to a personal website when it's a website of a porn actor/actress or a media sharing website where user can upload from their own sexually explicit material to movies made by adult studios.

30. **Question and Answer (Q&A) Site:** Answer site is a site where people can ask questions & get answers.

31. **Rating site:** A site on which people can praise or laugh at what is featured.
32. **Religious site:** A site in which people may advertise a place of worship, or provide inspiration or seek to encourage the faith of a follower of that religion.
33. **Review site:** A site on which people can post reviews for products or services.
34. **School site:** A site on which teachers, students, or administrators can post information about current events at or involving their school. U.S. elementary-high school websites generally use k12 in the URL
35. **Scraper site:** a site which largely duplicates without permission the content of another site, without actually pretending to be that site, in order to capture some of that site's traffic (especially from search engines) and profit from advertising revenue or in other ways.
36. **Search engine site:** A website that indexes material on the Internet or an intranet (and lately on traditional media such as books and newspapers) and provides links to information as a response to a query.
37. **Shock site:** Includes images or other material that is intended to be offensive to most viewers
38. **Showcase site:** Web portals used by individuals and organizations to showcase things of interest or value
39. **Social bookmarking site:** A site where users share other content from the Internet and rate and comment on the content.

- 40. Social networking site:** A site where users could communicate with one another and share media, such as pictures, videos, music, blogs, etc. with other users. These may include games and web applications.
- 41. Warez:** A site designed to host or link to materials such as music, movies and software for the user to download.
- 42. Webmail:** A site that provides a webmail service.
- 43. Web portal:** A site that provides a starting point or a gateway to other resources on the Internet or an intranet.
- 44. Wiki site:** A site which users collaboratively edit its content.

A Web server is a computer that delivers Web pages requested by users. Multiple Web sites can be stored on the same Web server.

A Webmaster is the individual responsible for developing Web pages and maintaining a Web site. Web publishing is the development and maintenance of Web page.

Search engines

A search engine is a software program that can be used to find Web sites, Web pages, and files on the Internet.

To find a Web site or Web page, the user just enters a word or phrase, called the keywords or search text, in the search engine's text box, and the search engine then displays a list of all the Web sites or Web pages that match the keywords or search text entered.

The URLs of several Internet search engines are listed below:

Search Engine	URL
AltaVista	www.altavista.com
Excite	www.excite.com
Google	www.google.com
HotBot	www.hotbot.com
Lycos	www.lycos.com
WebCrawler	www.webcrawler.com
Yahoo!	www.yahoo.com
Askme!	www.askme.com

Using the e-mail:

E-mail, or electronic mail, is the transmission of messages via a computer network such as a local area network or the Internet.

The message can be simple text, or can include an attachment such as a word processing document, a graphical image, an audio clip, or a video clip.

E-mail software creates, sends, receives, forwards, stores, prints, and deletes e-mail messages.

An e-mail address is a combination of a user name and a domain name that identifies a user who sends or receives e-mail. (e.g., for the e-mail address *mwendhamd@live.com*, *mwendhamdmd* is the user name, *live.com* is the domain name.)

Most e-mail programs allow users to create an address book, which contains a list of names and e-mail addresses. Most ISPs provide their users with a mailbox, which stores their e-mails, on a special server called a mail server.

When an e-mail arrives at the recipient's mail server, the e-mail transfers to a POP or POP3 server, until the recipient retrieves it with his or her e-mail software.

Popular e-mail software includes Microsoft Outlook Express and Eudora. Some Web sites provide e-mail services called Webmail, which can be accessed by a Web browser.

Structure of an e-mail

An e-mail is made up of many components that include:

1. **Compose, new:** enables one to write a new e-mail
2. **Subject:** the user writes the title or heading of the message.
3. **To:** write the e-mail address of the recipient of the e-mail
4. **C.C.:** make a copy of work to other recipients, but all will know that others have received a copy of the e-mail
5. **B.C.C.:** makes a copy of an e-mail to other recipients, but all will not know that others have a copy of the same e-mail.
6. **In box:** shows that list of all incoming e-mails.
7. **Delete:** removes an e-mail from the in-box.
8. **Flag as read:** shows that the e-mail was read.

Advantages of using an e-mail over ordinary mail

- a) Emails are delivered extremely fast when compared to traditional post.
- b) Emails can be sent 24 hours a day, 365 days a year.
- c) Webmail means emails can be sent and received from any computer, anywhere in the world, that has an Internet connection.
- d) Cheap - when using broadband, each email sent is effectively free. Dial-up users are charged at local call rates but it only takes

a few seconds (for conventional email, e.g. text only) to send an email.

- e) Emails can be sent to one person or several people.
- f) Computer files can be attached to an email.
- g) Records and copies are kept automatically.

Disadvantages of using an e-mail over ordinary mail

- ✓ A computer and other hardware (e.g., a modem) is required.
- ✓ It is not secure.
- ✓ It is easy to get on junk mail lists.
- ✓ The recipient needs access to the Internet to receive email.
- ✓ Viruses are easily spread via email attachments (most email providers scan emails for viruses on your behalf).
- ✓ Phishing - sending an email to a user falsely claiming to be a legitimate company to scam the user into providing information, such as personal information and bank account numbers on a bogus website. The details will then be used for identity theft.
- ✓ No guarantee the mail will be read until the user logs on and checks their email.
- ✓ Spam - unsolicited email, i.e. junk mail.

Cyber crime

Cybercrime refers to online or Internet-based illegal acts. These include: -

1. **Spam:** or the unsolicited sending of bulk email for commercial purposes, is unlawful. This involves sending bulk mail to persons not known to you.
2. **Fraud:** is any dishonest distortion of fact intended to let another to do or refrain from doing something which causes loss. In this context, the fraud will result in obtaining a benefit by:
 - a) Altering computer input in an unauthorized way. This requires little technical expertise and is not an uncommon form of theft by employees altering the data before entry or entering false data, or by entering unauthorized instructions or using unauthorized processes;
 - b) Altering, destroying, suppressing, or stealing output, usually to cover up unauthorized transactions: this is difficult to detect;
 - c) Altering or deleting stored data;
 - d) Altering or misusing existing system tools or software packages, or altering or writing code for fraudulent purposes.
3. **Obscene or offensive content:** The content of websites and other electronic communications may be unpleasant, obscene or offensive for a variety of reasons. In some instances these communications may be illegal e.g. pornography.
4. **Harassment:** it directs obscenities and belittling comments at specific individuals focusing for example on gender, race, religion, nationality, sexual orientation.

5. **Threats:** it involves written or recorded messages intended to scare an individual or a group of individuals as a group. This may involve writing threatening, belittling messages to the user.
6. **Drug trafficking:** Drug traffickers are increasingly taking advantage of the Internet to sell their illegal substances through encrypted e-mail and other Internet Technology. Some drug traffickers arrange deals at internet cafes, use courier Web sites to track illegal packages of pills, and swap guidelines for access in say chat rooms. The rise in Internet drug trades could also be attributed to the lack of face-to-face communication.
7. **Cyber terrorism:** can be defined as an act of terrorism committed through the use of cyberspace or computer resources (Parker 1983). As such, a simple propaganda in the Internet, that there will be bomb attacks during the holidays can be considered cyber terrorism.
8. An **online predator** is an adult Internet user who exploits vulnerable children or teens, usually for sexual or other abusive purposes.

Revision questions

1. (a). Define the term internet.
(b). Mention any four requirements for accessing the internet.
2. (a). Outline five services of the internet.
(b). briefly, explain seven advantages and six disadvantages of Using the internet.
3. (a). What is e-commerce?
(b). State five advantages of e-commerce to a business.
4. (a). Write WWW in full.
(b). State the difference between WWW and the internet.

5. (a). Define a web browser.
(b). Give five examples of web browsers in common use.
(c). Explain briefly the following websites:
 - i.) Affiliate.
 - ii.) Blog.
 - iii.) Content site.
 - iv.) Gripe site.
 - v.) P2P torrent site.
 - vi.) Social networking site.

6. (a). Give the difference between a webpage and a website.
(b). State four examples of search engines.

7. (a). What are search engines?
(b). State four examples of search engines.

8. (a). What is an e-mail?
(b). State four advantages and five disadvantages of using an E-mail.

9. (a). Briefly, explain how an e-mail is transmitted.
(b). Give the meaning of the following:
 - i.) To
 - ii.) Compose, new
 - iii.) Subject
 - iv.) Attachment
 - v.) Flag

DATA COMMUNICATIONS

Data communications refer to one computer transferring data, instructions, and information to another computer or some other computers.

The basic model for computer communications consists of:

1. A sending device that initiates an instruction to transmit data, instruction, or information. e.g., Computer A, which sends out signals to another computer (e.g., Computer B).
2. A communications device that converts the data, instruction, or information from the sending device into signals that can be carried by a communications channel. e.g., Modem A, which converts the computer's digital signals into analog signals.
3. A communications channel, or path, over which the signals are sent. e.g., A standard telephone line, along which the analog signals are sent.
4. A communications device that receives the signals from the communications channel and converts them into a form understood by the receiving device. e.g., Modem B, which converts the analog signals back into digital signals.
5. A receiving device (i.e., Computer B) that accepts the signals from Computer A.
6. Communications software, which consists of programs that manage the transmission of data, instructions, and information between computers.

Uses of computer communications include

1. VoIP (VoIP, abbreviation of voice over Internet Protocol) commonly refers to the communication protocols, technologies, methodologies, and transmission techniques involved in the delivery of voice communications and multimedia sessions over Internet Protocol (IP) networks, such as the Internet.
2. Voice mail: functions like an answering machine and allows a caller to leave a voice message, which is stored in a voice mailbox, for the called party.
3. Fax: A facsimile (fax) machine is a device that transmits and receives documents over telephone lines. Documents sent or received via a fax machine are known as faxes. Fax capability can also be added to the computer using a fax modem.

Advantages of Fax

- ✓ Hard copies are available.

Disadvantages of Fax

- ✓ Sending a big document can be slow.
 - ✓ Wasteful of paper when junk faxes are sent
4. E-mail, or electronic mail, is the transmission of messages via a computer network such as a local area network or the Internet. The message can be simple text, or can include an attachment such as a word processing document, a graphical image, an audio clip, or a video clip.
 5. BBS: A bulletin board system (BBS) is a computer that maintains a centralized collection of electronic messages.

6. Instant messaging: is a real-time communications service that notifies a user when one or more people are online and then allows the user to exchange messages or files with them.
7. Chat rooms: is a location on an Internet server that permits users to chat with each other by typing lines of text on the computer. Some chat rooms support voice chats and video chats. To start a chat session, a user must connect to a chat server through a chat client program on his or her computer. Most Web browsers also include a chat client.
8. Newsgroups: also called a discussion group, is an online area where users conduct written discussions about a particular subject.
9. Internet telephony: sometimes called Voice over IP (VoIP), is a Web-based telephone service that allows a user to talk to others for just the cost of the Internet connection.
10. Videoconferencing: is a meeting between two or more geographically separated people who use a network or the Internet to transmit audio and video data.
 - ✓ A videoconference conducted over the Internet, using Web browsers and Web servers to deliver the service, is called a Web conference.
 - ✓ A videoconference allows participants to collaborate as if they were in the same room.
 - ✓ Videoconferencing software along with a microphone, speakers, and a digital video camera attached to the computer are required to participate in a videoconference.

11. Groupware: is a software application that helps groups of people work together and share information over a network. Groupware enables members of a workgroup to communicate, manage projects, schedule meetings, and make group decisions
12. Telecommuting: is a work arrangement so that employees may work away from the standard workplace of a company, but communicate with the office using some kinds of communications technology.

Advantages of telecommuting include

- ✓ Reduces the time and expenses for traveling to and from work.
- ✓ Eliminates traveling during unsafe weather conditions.
- ✓ Allows a flexible work schedule for employees.
- ✓ Provide a convenient, comfortable work environment for disabled employees or those recovering from injury or illness.
- ✓ Reduces air pollution caused by vehicles driven to and from work.
- ✓ Employers reduce costs due to less office space and furniture is required.

Disadvantages of telecommuting include

- ✓ Reduced human face-to-face interactions among working staff.
- ✓ Work has to stop if any component of the communications system fails to work.
- ✓ Leisure time at home may be replaced by work.
- ✓ Data security may be jeopardized.

13. Global positioning system (GPS): consists of one or more earth-based receivers that accept and analyze signals sent by satellites in order to determine the receiver's geographic location.

Uses of GPS include

- ✓ To locate a person or an object

- ✓ Ascertain the best route between two points
- ✓ Monitor the movement of a person or object
- ✓ Create a map
- ✓ Many cars and ships also use GPS to provide directions to a destination and weather information.

14. FTP: (File Transfer Protocol) is an Internet standard that allows users to upload and download files with other computers. Common terms related to FTP include:

- An FTP server is a computer that allows users to upload and download files using FTP.
- An FTP site is a collection of files that reside on an FTP server. Some FTP sites limit file transfers to users who have authorized accounts. Many FTP sites allow anonymous FTP, so that anyone can transfer some or all available files.

An operating system with FTP capabilities or a separate FTP program is required to upload files to an FTP site.

15. Blog: is a discussion or informational site published on the World Wide Web and consisting of discrete entries ("posts") typically displayed in reverse order (the most recent post appears first).

16. RSS (Rich Site Summary) (originally RDF Site Summary, often dubbed Really Simple Syndication) is a family of web feed formats used to publish frequently updated works—such as blog entries, news headlines, audio, and video—in a standardized format. An RSS document (which is called a "feed", "web feed", or "channel") includes full or summarized text, plus metadata such as publishing dates and authorship.

17. Wiki: is a website which allows its users to add, modify, or delete its content using a web browser usually with help of a simplified

markup language or a rich-text editor. Wikis are powered by wiki software. Most are created collaboratively.

Wikis serve many different purposes, such as knowledge management and note taking. Wikis can be community websites and intranets. Some permit control over different functions (levels of access). Editing rights may permit changing, adding or removing material. Others permit access without implementing access control. Other rules may also be imposed for organizing content.

18. Internet: The Internet is a worldwide collection of networks linked together.
19. Web 2.0: Describes web sites that use technology beyond the static pages of earlier web sites. A Web 2.0 site may allow users to interact and collaborate with each other in a social media dialogue as creators of user-generated content in a virtual community, in contrast to websites where people are limited to the passive viewing of content. Examples of Web 2.0 include social networking sites, blogs, wikis, video sharing sites, hosted services, web applications, mashups and folksonomies.
20. Web collaboration: It provides an organization with the capability to work together with customers or internally via the Internet in real time. Web collaboration packages generally consist of Web-based tools within Web sites to assist an organization in the area of sales, new revenue-generation opportunities, and to enhance customer satisfaction.

Web collaboration is essentially the back-end software or service that allows your center to share Web pages with customers while offering voice and text chat assistance or to conduct single or multi-user conferences and seminars.

Revision questions

1. (a). Define the term 'data communication'.
(b). Briefly explain the basic model for data communication.
2. (a). Explain five uses of computer communication.
(b). State three advantages of using:
 - i.) Videoconferencing.
 - ii.) Telecommuting.
 - iii.) Fax.
3. (a). Distinguish between a wiki and an RSS feed.
(b). Write the following in full:
 - i.) RSS
 - ii.) FTP
 - iii.) GPS
 - iv.) BBS
 - v.) VoIP
(c). State three uses of GPS to an organisation.

COMPUTER NETWORKS

What is a Network?

A network consists of two or more computers that are linked in order to share resources (such as printers and CDs), exchange files, or allow electronic communications.

The computers on a network may be linked through cables, telephone lines, radio waves, satellites, or infrared light beams.

Common types of networks include

Local Area Network

A Local Area Network (LAN) is a network that is confined to a relatively small geographical area.

It is generally limited to a geographic area such as a writing lab, school, or building.

Metropolitan Area Network

A Metropolitan Area Network (MAN) is a network that is slightly larger than a LAN but smaller than a WAN.

It covers about a district, or a university campus.

Wide Area Network

Wide Area Networks (WANs) connect networks in larger geographic areas, such as the world.

Dedicated transoceanic cabling or satellite uplinks may be used to connect this type of global network.

Wireless LANs



More and more networks are operating without cables, in the wireless mode. Wireless LANs (WLAN) use high frequency radio signals, infrared light beams, or lasers to communicate between the workstations, servers, or hubs.

Each workstation and file server on a wireless network has some sort of transceiver/antenna to send and receive the data. Information is relayed between transceivers as if they were physically connected.

For longer distance, wireless communications can also take place through cellular telephone technology, microwave transmission, or by satellite.

Wireless standards and speeds

The Wi-Fi Alliance is a global, non-profit organization that helps to ensure standards and interoperability for wireless networks, and wireless networks are often referred to as Wi-Fi (Wireless Fidelity). The original Wi-Fi standard (IEEE 802.11) was adopted in 1997. Since then many variations have emerged (and will continue to emerge). Wi-Fi networks use the Ethernet protocol.

Standard	Max Speed	Typical Range
802.11a	54 Mbps	150 feet
802.11b	11 Mbps	300 feet
802.11g	54 Mbps	300 feet
802.11n	100 Mbps	300+ feet

Advantages of Installing Network

1. User access control.

User information is easily monitored to ensure privacy while using a network. It also ensures user safety while using a computer network.

2. Information storing and sharing.

Computers allow users to create and manipulate information. Information takes on a life of its own on a network.

The network provides both a place to store the information and means to share that information with other network users.

3. Connections

Administrators, instructors, and even students and guests can be connected using the campus network. This makes communication easy amongst users of a given organisation.

4. Services

An organisation can provide services, such as registration, school directories, course schedules, access to research, and email accounts, and many others.

5. Internet

The school can provide network users with access to the internet, via an internet gateway.

6. Computing resources

The school can provide access to special purpose computing devices which individual users would not normally own. For example, a

school network might have high-speed high quality printers strategically located around a campus for instructor or student use.

7. Flexible Access

Computer networks enable people to access their information from connected devices throughout the organisation. Students can begin an assignment in their classroom, save part of it on a public access area of the network, then go to the media center after school to finish their work. Students can also work co-operatively through the network.

8. Workgroup Computing

Collaborative software allows many users to work on a document or project concurrently. For example, educators located at various schools within a county could simultaneously contribute their ideas about new curriculum standards to the same document, spreadsheets, or website.

Disadvantages of Installing a School Network

1. Expensive to Install

Large campus networks can carry large price tags. Cabling, network cards, routers, bridges, firewalls, wireless access points, and software can get expensive, and the installation would certainly require the services of technicians.

2. Requires Administrative Time

Proper maintenance of a network requires considerable time and expertise.

Many organizations have installed a network, only to find that they did not budget for the necessary administrative support.

3. Servers Fail

Although a network server is liable to failure than any other computer, when the files server "goes down" the entire network may bring work to a standstill.

4. Cables May Break

One broken cable can stop the entire network.

5. Security and compliance

Network security is expensive. A great deal of attention must be paid to network services to ensure all network content is appropriate for the network community it serves.

Network architecture

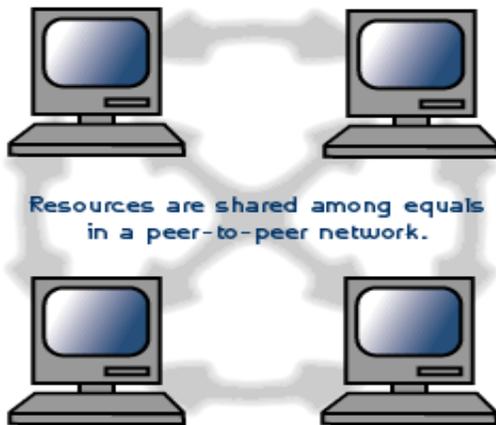
The two major types of network architecture are:

1. Peer-to-Peer
2. Client/Server

Peer-to-Peer

Peer-to-peer network architecture allows users to share resources and files located on their computers and to access shared resources found on other computers. However, they do not have a file server or a centralized management source.

In a peer-to-peer network, all computers are considered equal; they all have the same abilities to use the resources available on the network. Peer-to-peer networks are designed primarily for small to medium local area networks.



Advantages of a peer-to-peer network

- Less initial expense - No need for a dedicated server.
- Setup - An operating system (such as Windows XP) already in place may only need to be reconfigured for peer-to-peer operations.

Disadvantages of a peer-to-peer network

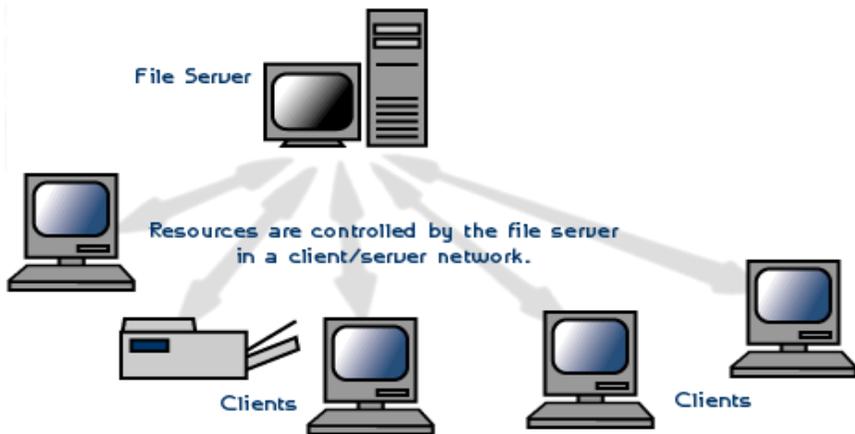
- Decentralized - No central store for files and applications.
- Security - Does not provide the security available on a client/server network.

Client/Server

Client/server network architecture allows the network to centralize functions and applications in one or more dedicated file servers. The file servers become the heart of the system, providing access to resources and providing security.

Individual workstations (clients) have access to the resources available on the file servers.

A **server** is the **host** or **central computer** that manages the resources on a network. A server provides a centralized storage area for programs, data, and information.



Advantages of a client/server network

1. Centralized - Resources and data security are controlled through the server.
2. Scalability - Any or all elements can be replaced individually as needs increase.
3. Flexibility - New technology can be easily integrated into system.
4. Interoperability - All components (client/network/server) work together.
5. Accessibility - Server can be accessed remotely and across multiple platforms.

Disadvantages of a client/server network

1. Expense - Requires initial investment in dedicated server.
2. Maintenance - Large networks will require a staff to ensure efficient operation.

3. Dependence - When server goes down, operations will cease across the network.

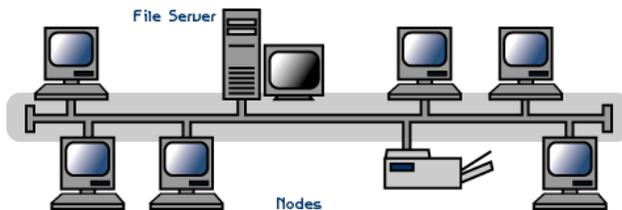
Network Topology

The physical topology of a network refers to the configuration of cables, computers, and other peripherals. Physical topology should not be confused with logical topology which is the method used to pass information between workstations. Logical topology was discussed under Network Protocols.

Main Types of Physical Topologies

Line / Linear / Bus / Multi – drop topology

A linear bus topology consists of a main run of cable with a terminator at each end. All nodes (file server, workstations, and peripherals) are connected to the linear cable.



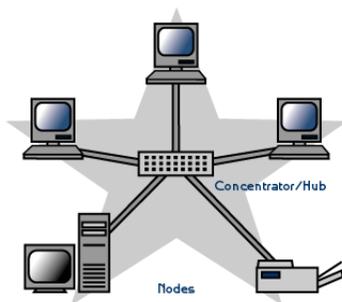
Advantages of a Linear Bus Topology

1. Easy to implement and extend.
2. Well suited for temporary networks (quick set-up).
3. Typically the cheapest topology to implement.
4. Failure of one station does not affect others.
5. Easy to connect a computer or peripheral to a linear bus.
6. Requires less cable length than a star topology.

Disadvantages of a Linear Bus Topology

1. Limited cable length and number of stations
2. A cable break can disable the entire network
3. Maintenance costs may be higher in the long run
4. Performance degrades as additional computers are added
5. Entire network shuts down if there is a break in the main cable.
6. Terminators are required at both ends of the backbone cable.
7. Difficult to identify the problem if the entire network shuts down.
8. Not meant to be used as a stand-alone solution in a large building.

Star topology



A star topology is designed with each node (file server, workstations, and peripherals) connected directly to a central network hub, switch, or concentrator. Data on a star network passes through the hub, switch, or concentrator before continuing to its destination.

The hub, switch, or concentrator manages and controls all functions of the network. It also acts as a repeater for the data flow. This configuration is common with twisted pair cable; however, it can also be used with coaxial cable or fiber optic cable.

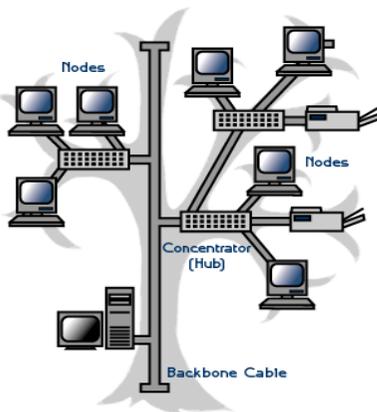
Advantages of a Star Topology

1. Easy to install and wire.
2. No disruptions to the network when connecting or removing devices.
3. Easy to detect faults and to remove parts.

Disadvantages of a Star Topology

1. Requires more cable length than a linear topology.
2. If the hub, switch, or concentrator fails, nodes attached are disabled.
3. More expensive than linear bus topologies because of the cost of the hub

Tree or Expanded Star



A tree topology combines characteristics of linear bus and star topologies. It consists of groups of star - configured workstations connected to a linear bus backbone cable. Tree topologies allow for the expansion of an existing network, and enable schools to configure a network to meet their needs.

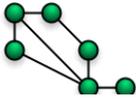
Advantages of a Tree Topology

1. Point-to-point wiring for individual segments.
2. Supported by several hardware and software vendors.

Disadvantages of a Tree Topology

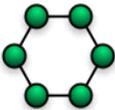
1. Overall length of each segment is limited by the type of cabling used.
2. If the backbone line breaks, the entire segment goes down.
3. More difficult to configure and wire than other topologies.

Mesh topology



A network topology in which there are at least two nodes with two or more paths between them. A special kind of mesh, limiting the number of hops between two nodes, is a hypercube.

Ring topology



A network topology in which every node has exactly two branches connected to it. These nodes and branches form a ring. If one of the nodes on the ring fails then the ring is broken and cannot work. A dual ring topology has four branches connected to it, and is more resistant to failures.

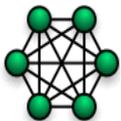
Advantages

1. Growth of the system has minimal impact on performance
2. All stations have equal access
3. Each node on the ring acts as a repeater, allowing ring networks to span greater distances than other physical topologies.

Disadvantages

1. Often the most expensive topology
2. Failure of one computer may impact others

A grid network



Is a kind of computer network consisting of a number of (computer) systems connected in a grid topology.

In a regular grid topology, each node in the network is connected with two neighbours along one or more dimensions. If the network is one-dimensional, and the chain of nodes is connected to form a circular loop, the resulting topology is known as a ring.

Considerations when choosing a network topology

1. Cost of installation
2. Number of computers and other devices
3. Architecture of the building to be used.
4. Purpose of the network.
5. Distance of connectivity
6. Safety provisions of the network
7. Personnel provisions/technicalities involved
8. Ease in accessing the network/ speed on the network.
9. Future growth of the organization and expansion of the network.

Protocol

What is a Protocol?

A protocol is a set of rules that governs communications between computers on a network.

In order for two computers to talk to each other, they must be speaking the same language. Many different types of network protocols and standards are required to ensure that your computer (no matter which operating system, network card, or application you are using) can communicate with another computer located on the next desk or half-way around the world.

The OSI (Open Systems Interconnection) Reference Model defines seven layers of networking protocols.

They can be simplified into four layers to help identify some of the protocols with which you should be familiar.

OSI Layer	Name	Common Protocols
7	Application	HTTP FTP SMTP DNS Telnet
6	Presentation	
5	Session	
4	Transport	TCP SPX
3	Network	IP IPX
2	Data Link	Ethernet
1	Physical	

The figure above illustrates how some of the major protocols would connect to the OSI model in order to communicate via the Internet. In this model, there are four layers, including:

- Ethernet (Physical/Data Link Layers)
- IP/IPX (Network Layer)
- TCP/SPX (Transport Layer)
- HTTP, FTP, Telnet, SMTP, and DNS(combined Session / Presentation / Application Layers)

Assuming you want to send an e-mail message to someone in Italy, we will examine the layers "from the bottom up" -- beginning with Ethernet (physical/data link layers).

Ethernet (Physical / Data Link Layers)

The physical layer of the network focuses on hardware elements, such as cables, repeaters, and network interface cards. By far the most common protocol used at the physical layer is Ethernet. For example, an Ethernet network (such as 10BaseT or 100BaseTX) specifies the type of cables that can be used, the optimal topology (star vs. bus, etc.), the maximum length of cables, etc.

The data link layer of the network addresses the way that data packets are sent from one node to another. Ethernet uses an access method called CSMA/CD (Carrier Sense Multiple Access / Collision

Detection). This is a system where each computer listens to the cable before sending anything through the network. If the network is clear, the computer will transmit.

If some other node is already transmitting on the cable, the computer will wait and try again when the line is clear. Sometimes, two computers attempt to transmit at the same instant. When this happens a collision occurs. Each computer then backs off and waits a random amount of time before attempting to retransmit.

With this access method, it is normal to have collisions. However, the delay caused by collisions and retransmitting is very small and does not normally affect the speed of transmission on the network.

Fast Ethernet

The Fast Ethernet protocol supports transmission up to 100 Mbps. Fast Ethernet requires the use of different, more expensive network concentrators / hubs and network interface cards. In addition, category 5 twisted pair or fiber optic cable is necessary. Fast Ethernet standards include:

- 100BaseT - 100 Mbps over 2-pair category 5 or better UTP cable.
- 100BaseFX - 100 Mbps over fiber cable.
- 100BaseSX - 100 Mbps over multimode fiber cable.
- 100BaseBX - 100 Mbps over single mode fiber cable.

Gigabit Ethernet

Gigabit Ethernet standard is a protocol that has a transmission speed of 1 Gbps (1000 Mbps). It can be used with both fiber optic cabling and copper.

- 1000BaseT - 1000 Mbps over 2-pair category 5 or better UTP cable.

- 1000BaseTX - 1000 Mbps over 2-pair category 6 or better UTP cable.
- 1000BaseFX - 1000 Mbps over fiber cable.
- 1000BaseSX - 1000 Mbps over multimode fiber cable.
- 1000BaseBX - 1000 Mbps over single mode fiber cable.

The Ethernet standards continue to evolve. with 10 Gigabit Ethernet (10,000 Mbps) and 100 Gigabit Ethernet (100,000 Mbps),

Ethernet Protocol Summary

Protocol	Cable	Speed
Ethernet	Twisted Pair, Coaxial, Fiber	10 Mbps
Fast Ethernet	Twisted Pair, Fiber	100 Mbps
Gigabit Ethernet	Twisted Pair, Fiber	1000 Mbps

IP and IPX (Network Layer)

The network layer is in charge of routing network messages (data) from one computer to another. The common protocols at this layer are IP (which is paired with TCP at the transport layer for Internet network) and IPX (which is paired with SPX at the transport layer for some older Macintosh, Linux, UNIX, Novell and Windows networks). Because of the growth in Internet-based networks, IP/TCP are becoming the leading protocols for most networks.

Every network device (such as network interface cards and printers) has a physical address called a MAC (Media Access Control) address. When you purchase a network card, the MAC address is fixed and cannot be changed.

Networks using the IP and IPX protocols assign logical addresses (which are made up of the MAC address and the network address) to the devices on the network, Network layer takes care of assigning the

correct addresses (via IP or IPX) and then uses routers to send the data packets to other networks.

TCP and SPX (Transport Layer)

The transport layer is concerned with efficient and reliable transportation of the data packets from one network to another. In most cases, a document, e-mail message or other piece of information is not sent as one unit. Instead, it is broken into small data packets, each with header information that identifies its correct sequence and document.

When the data packets are sent over a network, they may or may not take the same route. At the receiving end, the data packets are re-assembled into the proper order. After all packets are received, a message goes back to the originating network. If a packet does not arrive, a message to "re-send" is sent back to the originating network.

TCP, paired with IP, is by far the most popular protocol at the transport level. If the IPX protocol is used at the network layer (on networks such as Novell or Microsoft), then it is paired with SPX at the transport layer.

HTTP, FTP, SMTP and DNS (Session/Presentation/Application Layers)

Several protocols overlap the session, presentation, and application layers of networks. There protocols listed below are a few of the more well-known:

1. **DNS** - Domain Name System - translates network address (such as IP addresses) into terms understood by humans (such as Domain Names) and vice-versa
2. **DHCP** - Dynamic Host Configuration Protocol - can automatically assign Internet addresses to computers and users

3. **FTP** - File Transfer Protocol - a protocol that is used to transfer and manipulate files on the Internet
4. **HTTP** – Hyper Text Transfer Protocol - An Internet-based protocol for sending and receiving WebPages
5. **IMAP** - Internet Message Access Protocol - A protocol for e-mail messages on the Internet
6. **IRC** - Internet Relay Chat - a protocol used for Internet chat and other communications
7. **POP3** - Post Office protocol Version 3 - a protocol used by e-mail clients to retrieve messages from remote servers
8. **SMTP** - Simple Mail Transfer Protocol - A protocol for e-mail messages on the Internet

Other common network communication standards:

1. **Bluetooth:** is a kind of short-range (about 10 meters) broadcast radio communications, which can transmit data at a rate of 1 Mbps among Bluetooth-enabled devices.

Examples of Bluetooth devices include desktop computers, notebook computers, handheld computers, Internet appliances, cellular telephones, and printers.

2. **UWB (also known as UWB, ultra-wide band and ultra band):** is a radio technology which may be used at a very low energy level for short-range, high-bandwidth communications using a large portion of the radio spectrum.

3. IrDA (Infrared Data Association): allows wireless devices to transmit data via infrared light waves. The IrDA port on the computer and the IrDA port on the peripheral device must be aligned so that nothing obstructs the path of the infrared light wave.

Devices that use IrDA ports include keyboards, mouse, and printer.

4. RFID (Radio-Frequency Identification): is the use of a wireless non-contact system that uses radio-frequency electromagnetic fields to transfer data from a tag attached to an object, for the purposes of automatic identification and tracking. Some tags require no battery and are powered and read at short ranges via magnetic fields (electromagnetic induction).

Others use a local power source and emit radio waves (electromagnetic radiation at radio frequencies). The tag contains electronically stored information which can be read from up to several meters (yards) away. Unlike a bar code, the tag does not need to be within line of sight of the reader and may be embedded in the tracked object

5. WiMAX (Worldwide Interoperability for Microwave Access): is a wireless communications standard designed to provide 30 to 40 megabit-per-second data rates, with the 2011 update providing up to 1 Gbit/s for fixed stations. WiMAX is described as "a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL".
6. WAP (Wireless Application Protocol): is a technical standard for accessing information over a mobile wireless network. A WAP browser is a web browser for mobile devices such as mobile phones that uses the protocol.

Before the introduction of WAP, mobile service providers had limited opportunities to offer interactive data services, but needed interactivity to support Internet and Web applications such as:

- ✓ Email by mobile phone
- ✓ Tracking of stock-market prices
- ✓ Sports results
- ✓ News headlines
- ✓ Music downloads

Revision questions

1. (a). What is a network?
(b). Write short notes on the following:
 - i.) LAN.
 - ii.) MAN.
 - iii.) WAN.
 - iv.) WLAN.

2. (a). State four advantages of installing computer networks.
(b). Outline four disadvantages of computer networks.

3. (a). Distinguish between a peer – to – peer and client / server network architecture.
(b). Explain the following forms of servers:
 - i.) A dedicated server.
 - ii.) File server.
 - iii.) Printer server.
 - iv.) Database server.
 - v.) Network server.
(c). State four advantages of a client / server network.

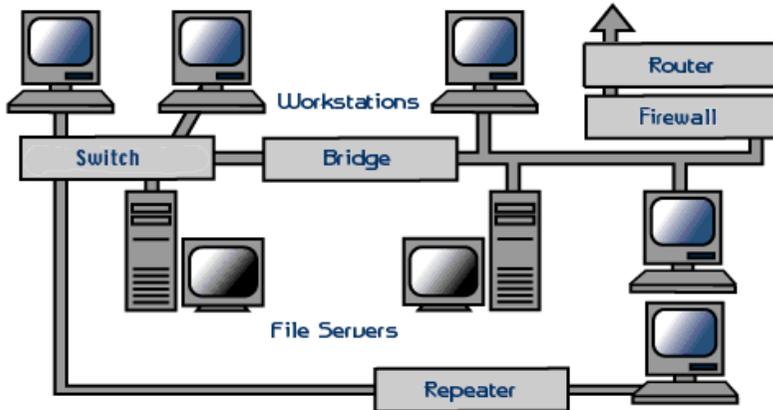
4. (a). Define a network topology.
(b). With illustrations, describe briefly any four examples of network topologies.

5. (a). What is a network protocol?
(b). Explain the following:
 - i.) IP/IPX.
 - ii.) TCP/SPX.
 - iii.) HTTP.
 - iv.) FTP.
 - v.) SMTP.
 - vi.) DNS.
 - vii.) DHCP.
 - viii.) Telnet.

6. (a). Describe the following:
 - i.) WAP.
 - ii.) WiMAX.
 - iii.) RFID.
 - iv.) IrDA.
 - v.) UWB.
 - vi.) Bluetooth.

NETWORK PHYSICAL TRANSMISSION MEDIA

Networking hardware includes all computers, peripherals, interface cards and other equipment needed to perform data-processing and communications within the network.



File / Network / Printer / Database Server

A server provides access control, file sharing, printer sharing, email, database, and other services. A server provides a centralized storage area for programs, data, and information.

Types of servers include:

- a) A **dedicated server** is a server that performs specific tasks.
- b) A **file server** stores and manages files.
- c) A **printer server** manages printers and print jobs.
- d) A **database server** stores and provides access to a database.
- e) A **network server** (e.g., a DNS) manages network traffic.

When configuring a server, budget is usually the controlling factor. The following guidelines should be followed:

1. Fastest processor(s)
2. Large amount of RAM
3. Multiple large, fast hard drives
4. Extra expansion slots
5. Fast network interface card(s)

Optionally (if no other such devices are available on the network):

6. A RAID (Redundant Array of Inexpensive Disks) to preserve large amounts of data (even after a disk failure)
7. A back-up unit (i.e. DAT tape drive, removable hard drives, or CD / DVD / BluRay burner)

Workstation

Is a computer that is configured with a network interface card, networking software, and the appropriate cables. Workstations do not necessarily need large storage hard drives, because files can be saved on the file server. Almost any computer can serve as a network workstation.

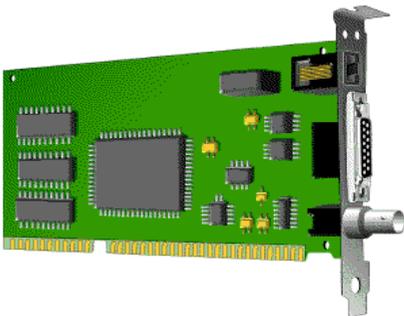
Network Interface Card

The network interface card (NIC) provides the physical connection between the network and the computer workstation. Most NICs are internal, and they are included in the purchase of most computers. Network interface cards are a major factor in determining the speed and performance of a network. It is a good idea to use the fastest network card available for the type of workstation you are using. The most common network interface connections are Ethernet cards and wireless adapters.

Ethernet Cards

Ethernet cards are usually included with a computer, although additional ethernet cards can be purchased and installed on most computers. Ethernet cards can contain connections for either coaxial or twisted pair cables (or both). If it is designed for coaxial cable, the connection will be BNC.

If it is designed for twisted pair, it will have a RJ-45 connection. Some Ethernet cards also contain an AUI connector. This can be used to attach coaxial, twisted pair, or fiber optics cable to an Ethernet card. When this method is used there is always an external transceiver attached to the workstation. Only the RJ-45 connector is found on most modern ethernet cards



From top to bottom:

RJ-45, AUI, and BNC connectors

Wireless Adapters

Wireless adapters are found in most portable devices, such as laptops, smart phones, and tablet devices.

External wireless adapters can be purchased and installed on most computers having an open USB (Universal Serial Bus) port, or unused expansion slot.

Switches

An Ethernet switch is a device that provides a central connection point for cables from workstations, servers, and peripherals. In a star topology, twisted-pair wire is run from each workstation to a central switch / hub. Most switches are active, that is they electrically amplify the signal as it moves from one device to another. The predecessor of the switch was the hub, which broadcasted all inbound packets out all ports of the device, creating huge amounts of unnecessary network traffic. Modern switches build a port map of all IP address which responds on each port, and only broadcasts on all ports when it doesn't have a packet's target IP address already in its port map. Switches are:

- Usually configured with 8, 12, or 24 RJ-45 ports
- Often used in a star or tree topology
- Available as "managed" or "unmanaged", with the later less expensive, but adequate for smaller networks
- Direct replacements for hubs, immediately reducing network traffic in most networks
- Usually installed in a standardized metal rack that also may store network servers, bridges, or routers

Repeaters

Since a signal loses strength as it passes along a cable, it is often necessary to boost the signal with a device called a repeater. The repeater electrically amplifies the signal it receives and rebroadcasts it. Repeaters can be separate devices or they can be included into a concentrator. They are used when the total length of your network cable exceeds the standards set for the type of cable being used.

Bridges

A bridge is a device that allows you to segment a large network into two smaller, more efficient networks. If you are adding to an older

wiring scheme and want the new network to be up-to-date, a bridge can connect the two.

The bridge manages the traffic to maintain optimum performance on both sides of the network. You might say that the bridge is like a traffic cop at a busy intersection during rush hour.

It keeps information flowing on both sides of the network, but it does not allow unnecessary traffic through. Bridges can be used to connect different types of cabling, or physical topologies. They must, however, be used between networks with the same protocol.

Routers

Routers are the traffic directors of the global internet. All routers maintain complex routing tables which allow them to determine appropriate paths for packets destined for any address. Routers communicate with each other, and forward network packets out of or into a network. Here's an example:

While bridges know the addresses of all computers on each side of the network, routers know the addresses other routers which in turn know about their own networks. Routers can even "listen" to entire networks to determine which sections are busiest -- they can then redirect data around those sections until traffic congestion clears.

So, routers are network gateways. They move network packets from one network to another, and many can convert from one network protocol to another as necessary. Routers select the best path to route a message, based on the destination address of the packet. The router can direct traffic to prevent head-on collisions, and is smart enough to know when to direct traffic along back roads and shortcuts.

If you have a school LAN that you want to connect to the Internet, you will need to purchase a router. In this case, the router serves as

the forwarder between the information on your LAN and the Internet. It also determines the best route to send the data over the Internet.

Firewalls

A firewall is a networking device that is installed at the entrance to a LAN when connecting networks together, particularly when connecting a private network to a public network, such as the internet. The firewall uses rules to filter traffic into and out of the private network, to protect the private network users and data from malicious hackers.

Firewalls are either hardware or software, depending on their intended use. A firewall used to protect a network is a hardware device that should be installed in the network between the router and the network. Almost all hardware firewalls will have at least two ports, labeled "Trusted" and "Untrusted". These terms imply the true nature of the firewall's responsibility to the private network. The public network is connected to the untrusted network port, and the private network is connected to the trusted port.

Firewall rules are usually simple, consisting of a verb, either allow or deny, the direction of the traffic, either inbound or outbound, and an address or other network traffic identifier. Firewall rules are cumulative, so general rules may be specified, and exceptions added as necessary. Some examples are:

- Allow outbound all (all private network users can do anything on the public network)
- Deny inbound all (default setting to prevent all traffic from the public or untrusted port, to the private port)
- Allow inbound port 80 (allow internet web traffic to come into network to find web servers)
- Allow inbound port 80 destined to 170.200.201.25 (allow inbound web traffic to a specific web server on your private network)

- Deny inbound from 201.202.1.1/24 (deny all inbound traffic from a specific IP address or range of addresses)

Software firewalls are commonly included in modern workstation and server operating systems. They operate in a similar way as hardware firewalls, except that they filter traffic in and out of the machine itself.

Revision questions

1. Write short notes on the following:

- | | |
|------------------------------|-----------------|
| i.) Work stations. | v.) Switches. |
| ii.) Network interface card. | vi.) Repeaters. |
| iii.) Ethernet cards. | vii.) Bridges. |
| iv.) Wireless adapters. | viii.) Routers. |
| | ix.) Firewalls. |

COMMUNICATIONS SOFTWARE

It consists of programs that help to establish a connection to another computer or network, and manage the transmission of data, instructions, and information between computers and other devices.

Communications software usually includes one or more of the following features:

- ✓ Dialing feature that allows a user to store, review, select, and dial telephone numbers to connect to another computer.
- ✓ File transfer feature that allows a user to send one or more files from one computer to another.
- ✓ Terminal emulation feature that allows a personal computer to act as a specific type of terminal, so that the user can connect to and access data and resources on a minicomputer or mainframe.
- ✓ Internet access feature that allows a user to use the computer to connect to the Internet to send e-mail, participate in chat rooms, visit World Wide Web sites, and so on.

Software related to communications includes

1. E-mail software

E-mail, or electronic mail, is the transmission of messages via a computer network such as a local area network or the Internet.

- a) The message can be simple text, or can include an attachment such as a word processing document, a graphical image, an audio clip, or a video clip.

- b) E-mail software creates, sends, receives, forwards, stores, prints, and deletes e-mail messages.
- c) An e-mail address is a combination of a user name and a domain name that identifies a user who sends or receives e-mail.
- d) Most e-mail programs allow users to create an address book, which contains a list of names and e-mail addresses.
- e) Most ISPs provide their users with a mailbox, which stores their e-mails, on a special server called a mail server.
- f) When an e-mail arrives at the recipient's mail server, the e-mail transfers to a POP or POP3 server, until the recipient retrieves it with his or her e-mail software.
- g) Popular e-mail software includes Microsoft Outlook Express and Eudora.
- h) Some Web sites provide e-mail services called Webmail, which can be accessed by a Web browser.

2. Web browser

A Web browser allows a user to access and view Web pages on the Internet.

- a) Most Web browsers also allow the use of other Internet services such as e-mail and chat rooms.
- b) Two popular Web browsers are Microsoft Internet Explorer and Netscape Navigator.

3. Chat room software

A chat room is a location on an Internet server that permits users to chat with each other by typing lines of text on the computer.

- a) Some chat rooms support voice chats and video chats.
- b) To start a chat session, a user must connect to a chat server through a chat client program on his or her computer.
- c) Most Web browsers also include a chat client.

4. Newsreader

A newsgroup, also called a discussion group, is an online area where users conduct written discussions about a particular subject. To participate in a discussion, a user sends a message to the newsgroup, and other users in the newsgroup read and reply to the message.

A thread or threaded discussion consists of the original message and all subsequent related replies. The entire collection of Internet newsgroups is called Usenet.

- a) The computer that stores and distributes newsgroup messages is called a news server.
- b) The difference between a chat room and a newsgroup is that a chat room is a live conversation while a newsgroup is not.
- c) A newsreader program is required to participate in a newsgroup, and most Web browsers include a newsreader.

5. Instant messenger

Instant messaging (IM) is a real-time communications service that notifies a user when one or more people are online and then allows the user to exchange messages or files with them.

- a) An instant messenger program from an instant messaging service must be installed in order to use instant messaging.
- b) No standards exist currently for instant messaging. All those individuals involved need to use the same instant messenger to guarantee successful communications.

6. Groupware

Groupware is a software application that helps groups of people work together and share information over a network. Groupware enables members of a workgroup to communicate, manage projects, schedule meetings, and make group decisions.

7. Videoconferencing software

A videoconference is a meeting between two or more geographically separated people who use a network or the Internet to transmit audio and video data.

- a) A videoconference conducted over the Internet, using Web browsers and Web servers to deliver the service, is called a Web conference.
- b) A videoconference allows participants to collaborate as if they were in the same room.
- c) A videoconferencing software along with a microphone, speakers, and a digital video camera attached to the computer are required to participate in a videoconference

Revision questions

1. (a). Define the term communication software.
(b). State four common features of a communication software.

2. (a). Explain the following as related to communication software.
 - i.) E-mail.
 - ii.) Web browser.
 - iii.) Newsreader.
 - iv.) Instant message.
 - v.) Group ware.

TELEPHONE NETWORK

The Public Switched Telephone Network (PSTN) is the worldwide telephone system that handles voice-oriented telephone calls.

The telephone network is originally built to handle voice communications. However, it is also a basic part of computer communications today. Data, instructions, and information can be sent over the telephone network using dial-up lines or dedicated lines.

Advantages of Telephone

- a) Immediate contact is available.
- b) Tone of voice helps communications.

Disadvantages of Telephone

- a) It may take a long time to get someone on the phone.
- b) Call is successful only when the person to contact is present.
- c) Time zone problems between different countries.

Dedicated lines

A dedicated line is a permanent connection between two communications devices.

- a) A leased line is a dedicated line leased from a telephone or communications service company.
- b) Dedicated lines can be analog or digital.
- c) Digital lines have faster transfer rates than analog lines.

Popular types of digital dedicated lines are

1. ISDN lines

ISDN (Integrated Services Digital Network) is a set of standards for digital transmission of data over standard copper telephone lines.

- a) With ISDN, the same telephone line that could normally carry only one signal, can now carry three or more signals at once using a technique called multiplexing.
- b) ISDN requires that both ends of the connection have an ISDN modem.
- c) ISDN lines also require a special ISDN telephone for voice communications.

Advantages of ISDN lines include

- a) Provides faster transfer rates than dial-up lines.
- b) Faster Web page downloads and clearer videoconferencing.
- c) Produce very clear voice conversations.

2. Digital subscriber lines

DSL (digital subscriber lines) provides high-speed connections to the Internet over a regular copper telephone line.

- a) The user must have a special network card or DSL modem to connect to a digital subscriber line.
- b) DSL is much easier to install and can provide much faster data transfer rates than ISDN.
- c) ADSL (asymmetric digital subscriber line) is a type of DSL that supports faster transfer rates when receiving data (i.e., downstream rate) than when sending data (i.e., upstream rate).
- d) ADSL is ideal for Internet access because most users download more information from the Internet than they upload.

3. Cable TV lines

The cable TV network also provides high-speed Internet connections for users equipped with a cable modem.

4. T-carrier lines

A T-carrier line is a digital line that carry multiple signals over a single communications line using the multiplexing technique.

- a) The most popular T-1 line can carry 24 separate signals at a transmission rate of 64 Kbps each, for a total transmission rate of 1.544 Mbps.
- b) A T-3 line is equal in speed to 28 T-1 lines, and can carry 672 individual signals at a transmission of 64 Kbps each, for a total transmission rate of 43 Mbps.
- c) The Internet backbone also use T-3 lines.

Advantages of T-carrier lines include

- a) T-carrier lines provide very fast data transfer rates.

Disadvantages if T-carrier lines include

- a) T-carrier lines are so expensive that only medium to large companies can afford the investment.

5. ATM

Asynchronous Transfer Mode (ATM) is a service that carries voice, data, video, and multimedia at extremely high speeds.

Advantages of a dedicated line include

- a) The quality and consistency of the connection is better than a dial-up line because dedicated lines provide a constant connection.

Dial up lines

Asynchronous transfer mode (ATM) is a service that carries voice, data, video, and multimedia at extremely high speeds.

With dial-up access, the user uses a computer, a modem, and a regular telephone line to dial into an ISP. A dial-up connection is a slow-speed technology.

Some users opt for high-speed technologies such as digital subscriber lines or cable television Internet services.

Revision questions

1. (a). State the advantages of using a telephone over using an e-mail.
(b). Give the difference between a dedicated line and a dial up line.

COMMUNICATION CHANNELS

Data travel from one computer to another using a number of communication channels that include cables, wireless transmission and other devices. Let us look at the following one by one beginning.

1. **Bandwidth:** refers to a measure of the channel capacity, or the maximum throughput (*the sum of the data rates that are delivered to all terminals in a network*) of a logical or physical communication path in a digital communication system.
2. **Latency:** is a measure of time delay experienced between communication terminals in a given time.
3. **Broad band:** refers to the wide bandwidth characteristics of a transmission medium and its ability to transport multiple signals and traffic types at the same time.
4. **Cable:** is a medium through which information usually moves from one network devices to another.

There are several types of cable which are commonly used with LANs. In some cases, a network will utilize only one type of cable, other networks will use a variety of cable types. The type of cable chosen for a network is related to the network's topology, protocol, and size.

Types of cables used in networks include:

1. Unshielded Twisted Pair (UTP) Cable
2. Shielded Twisted Pair (STP) Cable
3. Coaxial Cable
4. Fiber Optic Cable
5. Cable Installation Guides

Unshielded Twisted Pair (UTP) Cable



Twisted pair cabling comes in two varieties: shielded and unshielded. Unshielded twisted pair (UTP) is the most popular and is generally the best option for school networks

The quality of UTP may vary from telephone-grade wire to extremely high-speed cable. The cable has four pairs of wires inside the jacket. Each pair is twisted with a different number of twists per inch to help eliminate interference from adjacent pairs and other electrical devices. The tighter the twisting, the higher the supported transmission rate and the greater the cost per foot. The EIA/TIA (Electronic Industry Association/Telecommunication Industry Association) has established standards of UTP and rated six categories of wire (additional categories are emerging).

Categories of Unshielded Twisted Pair

Category	Speed	Use
1	1 Mbps	Voice Only (Telephone Wire)
2	4 Mbps	Local Talk & Telephone (Rarely used)
3	16 Mbps	10BaseT Ethernet
4	20 Mbps	Token Ring (Rarely used)
5	100 Mbps (2 pair)	100BaseT Ethernet
	1000 Mbps (4 pair)	Gigabit Ethernet
5e	1,000 Mbps	Gigabit Ethernet
6	10,000 Mbps	Gigabit Ethernet

Unshielded Twisted Pair Connector



The standard connector for unshielded twisted pair cabling is an RJ-45 connector. This is a plastic connector that looks like a large telephone-style connector. A slot allows the RJ-45 to be inserted only one way.

RJ stands for Registered Jack, implying that the connector follows a standard borrowed from the telephone industry. This standard designates which wire goes with each pin inside the connector.

Shielded Twisted Pair (STP) Cable

Although UTP cable is the least expensive cable, it may be susceptible to radio and electrical frequency interference (it should not be too close to electric motors, fluorescent lights, etc.). If you must place cable in environments with lots of potential interference, or if you must place cable in extremely sensitive environments that may be prone to the electrical current in the UTP, shielded twisted pair may be the solution. Shielded cables can also help to extend the maximum distance of the cables.

Shielded twisted pair cable is available in three different configurations:

1. Each pair of wires is individually shielded with foil.
2. There is a foil or braid shield inside the jacket covering all wires (as a group).
3. There is a shield around each individual pair, as well as around the entire group of wires (referred to as double shield twisted pair).

Coaxial Cable



Coaxial cabling has a single copper conductor at its center. A plastic layer provides insulation between the center conductor and a braided metal shield.

The metal shield helps to block any outside interference from fluorescent lights, motors, and other computers.

Although coaxial cabling is difficult to install, it is highly resistant to signal interference. In addition, it can support greater cable lengths

between network devices than twisted pair cable. The two types of coaxial cabling are thick coaxial and thin coaxial.

Coaxial Cable Connectors



The most common type of connector used with coaxial cables is the Bayone-Neill-Concelman (BNC) connector. Different types of adapters are available for BNC connectors, including a T-connector, barrel connector, and terminator. Connectors on the cable are the weakest points in any network. To help avoid problems with your network, always use the BNC connectors that crimp, rather than screw, onto the cable.

Fiber Optic Cable



Fiber optic cabling consists of a center glass core surrounded by several layers of protective materials. It transmits light rather than electronic signals eliminating the problem of electrical interference. This makes it ideal for certain environments that contain a large amount of electrical interference. It has also made it the standard for connecting networks between buildings, due to its immunity to the effects of moisture and lighting. Fiber optic cable has the ability to transmit signals over much longer distances than coaxial and twisted pair. It also has the capability to carry information at vastly greater speeds. This capacity broadens communication possibilities to include services such as video conferencing and interactive services.

Summary of cable types and specification

Specification	Cable Type
10BaseT	Unshielded Twisted Pair
10Base2	Thin Coaxial
10Base5	Thick Coaxial
100BaseT	Unshielded Twisted Pair

Specification	Cable Type
100BaseFX	Fiber Optic
100BaseBX	Single mode Fiber
100BaseSX	Multimode Fiber
1000BaseT	Unshielded Twisted Pair
1000BaseFX	Fiber Optic
1000BaseBX	Single mode Fiber
1000BaseSX	Multimode Fiber

Installing Cable - Some Guidelines

When running cable, it is best to follow a few simple rules:

- a) Always use more cable than you need. Leave plenty of slack.
- b) Test every part of a network as you install it. Even if it is brand new, it may have problems that will be difficult to isolate later.
- c) Stay at least 3 feet away from fluorescent light boxes and other sources of electrical interference.
- d) If it is necessary to run cable across the floor, cover the cable with cable protectors.
- e) Label both ends of each cable.
- f) Use cable ties (not tape) to keep cables in the same location together.

Wireless networks

Wireless transmission media send communications signals by using broadcast radio, cellular radio, microwaves, satellites, and infrared signals.

Wireless transmission media are used when it is inconvenient, impractical, or impossible to install wires and cables

Examples of wireless transmission media include

1. **Broadcast radio:** is a wireless transmission medium that distributes radio signals through the air.
 - a) A transmitter is needed to send the broadcast signal and a receiver is needed to accept the signal.
 - b) Some networks use a transceiver, which both sends and receives signals from wireless devices.
 - c) Bluetooth is a kind of short-range (about 10 meters) broadcast radio communications, which can transmit data at a rate of 1 Mbps among Bluetooth-enabled devices.

Examples of Bluetooth devices include desktop computers, notebook computers, handheld computers, Internet appliances, cellular telephones, and printers.

- d) Wireless networks using broadcast radio often use one of the 802.11 specifications.
 - e) The 802.11b specification provides transfer rates up to 11 Mbps.
 - f) The 802.11a specification provides transfer rates up to 54 Mbps.
2. **Cellular radio:** is a form of broadcast radio that is used widely for mobile communications, specifically cellular telephones.

- a) Personal Communications Services (PCS) is a set of technologies used for completely digital cellular devices such as handheld computers, cellular telephones, pagers, and fax machines.
- b) CDMA (Code Division Multiple Access) is the most popular PCS technology because of its fast transmission speed and lower cost.
- c) A newer technology, called 3G, provides even faster transfer rates than PCS so that users can display multimedia, watch TV, or conduct a videoconference on a cellular device.

3. **Microwaves:** are radio waves that provide a high-speed signal transmission.

- a) Microwaves transmission involves sending signals from one microwave station to another.
- b) Microwaves transmission is fast (up to 4,500 times faster than a dial-up modem) but is limited to line-of-sight transmission, which means that the microwaves must transmit in a straight line with no obstructions between microwave antennas.
- c) Microwaves stations often locate on the tops of buildings, towers, or mountains to avoid possible obstructions.
- d) Microwaves transmission is used where installing physical transmission media is difficult or impossible (e.g., deserts, lakes, or to communicate with a satellite), but light-of-sight transmission is available.

4. **Communications satellites:** is station in the space that receives microwaves signals from an earth-based station, amplifies the signals, and broadcasts the signals back over a wide area to many earth-based stations.

- a) Communications satellites are usually placed about 22,300 miles above the Earth's equator and moves at the same rate as the Earth.
- b) Applications of communications satellite include television and radio broadcasts, videoconferencing, paging, and global positioning systems.

Advantages of satellites

- a) Lots of data can be sent simultaneously.
- b) Allow high quality broadband communication across continents.

Disadvantages of satellites

- a) The fee to launch a satellite is extremely expensively.
- b) The infrastructure needed to access satellite communications is also expensive.

5. **Infrared (IR):** is a wireless transmission media that sends signals using infrared light waves.

- a) IR transmission also requires a line-of-sight transmission as that required by microwaves.
- b) Computer devices such as a mouse, printer, and digital camera, which have an IrDA port may transfer data from one device to another using infrared light waves.
- c) IR is an alternative to short-range broadcast radio communications such as Bluetooth.

Advantages of wireless networks:

1. **Mobility** - With a laptop computer or mobile device, access can be available throughout a school, at the mall, on an airplane, etc. More and more businesses are also offering free WiFi access ("Hot spots").
2. **Fast setup** - If your computer has a wireless adapter, locating a wireless network can be as simple as clicking "Connect to a Network" -- in some cases, you will connect automatically to networks within range.
3. **Cost** - Setting up a wireless network can be much more cost effective than buying and installing cables.
4. **Expandability** - Adding new computers to a wireless network is as easy as turning the computer on (as long as you do not exceed the maximum number of devices).

Disadvantages of wireless networks:

1. **Security** - Be careful. Be vigilant. Protect your sensitive data with backups, isolated private networks, strong encryption and passwords, and monitor network access traffic to and from your wireless network.
2. **Interference** - Because wireless networks use radio signals and similar techniques for transmission, they are susceptible to interference from lights and electronic devices.
3. **Inconsistent connections** - how many times you have hears "Wait a minute, I just lost my connection?" Because of the interference caused by electrical devices and/or items blocking the path of transmission, wireless connections are not nearly as stable as those through a dedicated cable.

4. **Speed** - The transmission speed of wireless networks is improving; however, faster options (such as gigabit Ethernet) are available via cables. If you are only using wireless for internet access, the actual internet connection for your home or school is generally slower than the wireless network devices, so that connection is the bottleneck. If you are also moving large amounts of data around a private network, a cabled connection will enable that work to proceed much faster.

Revision questions

1. (a). Define a communication channel.
(b). Write short notes on the following:
 - i.) Bandwidth.
 - ii.) Latency.
 - iii.) Broadband.
 - iv.) Cable.
2. (a). Give the difference between UTP and STP cables.
(b). Mention four guidelines for installing cables.
3. (a). What are wireless networks?
(b). Explain the various wireless transmission media.
4. (a). State three advantages and two disadvantages of using wireless networks.
(b). Describe the various types of cables used in networking.

EMERGING TECHNOLOGIES

1. Artificial intelligence

Artificial intelligence is a major feature of the fifth computer generation. It enables computers to behave and reason like human beings.

Application of artificial intelligence

a) Game playing

You can buy machines that can play master level chess. There is some AI in them, but they play well against people mainly through bully force computation--looking at hundreds of thousands of positions.

b) Speech recognition

In the 1990s, computer speech recognition reached a practical level for limited purposes. Thus United Airlines has replaced its keyboard tree for flight information by a system using speech recognition of flight numbers and city names. It is quite convenient.

c) Understanding natural language

Computers can be trained to learn and take instructions using natural languages. This is possible in some developed countries where robots understand this process.

d) Computer vision

The world is composed of three-dimensional objects, but the inputs to the human eye and computers' TV cameras are two dimensional. Some useful programs can work only in two dimensions, but full

computer vision requires partial three-dimensional information that is not just a set of two-dimensional views. At present there are only limited ways of representing three-dimensional information directly, and they are not as good as what humans evidently use.

e) Expert systems

A “knowledge engineer” interviews experts in a certain field and tries to represent their knowledge in a computer program for carrying out some task. How well this works depends on whether the academic method required for the task is within the present state of AI.

One of the first expert systems was MYCIN in 1974, which diagnosed bacterial infections of the blood and suggested treatments. It did better than medical students or practicing doctors.

f) Heuristic classification

One of the most possible kinds of expert system given the present knowledge of AI is to put some information in one of a fixed set of categories using several sources of information. An example is advising whether to accept a proposed credit card purchase. Information is available about the owner of the credit card, his record of payment and also about the item he is buying and about the firm from which he is buying it (e.g., about whether there have been previous credit card frauds at this establishment).

g) Computer science

AI researchers have created many tools to solve the most difficult problems in computer science. Many of their inventions have been adopted by mainstream computer science and are no longer considered a part of AI. All of the following were originally developed in AI laboratories:

- Time sharing.
- Interactive interpreters.
- Graphical user interfaces and the computer mouse,
- Rapid development environments.
- The linked list data structure.
- Automatic storage management.
- Symbolic programming.
- Functional programming.
- Dynamic programming and object-oriented programming.

h) Finance

Banks use artificial intelligence systems to organize operations, invest in stocks, and manage properties. In August 2001, robots beat humans in a simulated financial trading competition.

i) Hospitals and medicine

A medical clinic can use artificial intelligence systems to organize bed schedules, make a staff rotation, and provide medical information.

Artificial neural networks are used as clinical decision support systems for medical diagnosis, such as in Concept Processing technology in EMR software.

Other tasks in medicine that can potentially be performed by artificial intelligence include:

- ✓ Computer-aided interpretation of medical images. Such systems help scan digital images, *e.g.* from computed tomography, for typical appearances and to highlight conspicuous sections, such as possible diseases. A typical application is the detection of a tumor.

✓ Heart sound analysis

j) Heavy industry

Robots have become common in many industries. They are often given jobs that are considered dangerous to humans. Robots have proven effective in jobs that are very repetitive which may lead to mistakes or accidents due to a lapse in concentration and other jobs which humans may find shameful. Japan is the leader in using and producing robots in the world. In 1999, 1,700,000 robots were in use worldwide.

Similar techniques may be used in answering machines of call centers, such as speech recognition software to allow computers to handle first level of customer support, text mining and natural language processing to allow better customer handling, agent training by automatic mining of best practices from past interactions, support automation and many other technologies to improve agent productivity and customer satisfaction.

k) Transportation

Hairy logic controllers have been developed for automatic gearboxes in automobiles (the 2006 Audi TT, VW Toureg and VW Caravell feature the DSP transmission). The gear box automatically engages a necessary gear to enable the car move without much task from the driver.

l) Telecommunications

Many telecommunications companies make use of heuristic search in the management of their workforces, for example BT Group has deployed heuristic search in a scheduling application that provides the work schedules of 20,000 engineers.

m) Music

The evolution of music has always been affected by technology. With AI, scientists are trying to make the computer emulate the activities of the skillful musician. Composition, performance, music theory, sound processing are some of the major areas on which research in Music and Artificial Intelligence are focusing.

n) Aviation

The Air Operations Division AOD, uses AI for the rule based expert systems. The AOD has use for artificial intelligence for substitute operators for war and training simulators, mission management aids, support systems for tactical decision making, and post processing of the simulator data into symbolic summaries.

Airplane simulators are using artificial intelligence in order to process the data taken from simulated flights. Other than simulated flying, there is also simulated aircraft warfare. The computers are able to come up with the best success scenarios in these situations. The computers can also create strategies based on the placement, size, speed, and strength of the forces and counter forces. Pilots may be given assistance in the air during combat by computers..

o) News and publishing

The company Narrative Science makes computer generated news and reports commercially available, including summarizing team sporting events based on statistical data from the game. It also creates financial reports and real estate analyses.

p) Other

Various tools of artificial intelligence are also being widely deployed in:

- Speech and text recognition,
- E-mail spam filtering
- Applications are also being developed for gesture recognition (understanding of sign language by machines).
- Individual voice recognition.
- Global voice recognition (from a variety of people in a noisy room).
- Facial expression recognition for interpretation of emotion and non verbal cues.
- Robot navigation
- Obstacle avoidance
- Object recognition

2. Digital forensics

Digital forensics (sometimes known as **digital forensic science**) is a branch of investigative science around material found in digital devices, often in relation to computer crime for example, hacking, cracking, spamming, e.t.c.

The technical aspect of an investigation is divided into several sub-branches, relating to the type of digital devices involved;

Branches of digital forensics include

- Computer forensics

The goal of computer forensics is to explain the current state of a digital object; such as a computer system, storage medium or electronic document.

- Mobile device forensics

Mobile device forensics is a sub-branch of digital forensics relating to recovery of digital evidence or data from a mobile device.

- **Network forensics**

Network forensics is concerned with the monitoring and analysis of computer network traffic, both local and WAN/internet, for the purposes of information gathering, evidence collection, or intrusion detection. Traffic is usually intercepted at the packet level, and either stored for later analysis or filtered in real-time.

- **Database forensics**

Database forensics is a branch of digital forensics relating to the forensic study of databases and their metadata. Investigations use database contents, log files and in-RAM data to build a time-line or recover relevant information.

Revision questions:

1. (a). Define the term artificial intelligence.
(b). Explain ten areas where Artificial intelligence is applied.
2. (a). Define the term digital forensic.
(b). State the branches of digital forensic.

CAREERS IN THE COMPUTER INDUSTRY

The overall computer technology field is growing, thanks to the increasing trust of business and everyday affairs on computers.

This is great news indeed for those looking to join the field. One of the only computer science-related jobs to be wary of are positions in computer programming, as much of this work is being outsourced to different countries. However, most other computer science-related professions are experiencing an exciting growth.

The Fastest Growing Jobs in Computer Science include:

1. Computer and Information System Management

- a) These professionals serve as technology managers and decision makers within an institution or on a consulting basis.
- b) They ensure that the information technology and telecommunications of the company work and run smoothly.
- c) They assist other managers and executives in assessing the short- and long-term goals of the company, and subsequently recommend and implement technological solutions for reaching those goals.
- d) They oversee such areas as software development, network security, and Internet operations.
- e) They also work with computer engineers, Web designers, support specialists, and other IT professionals to implement and upgrade computer hardware and software, create intranet sites, develop Internet sites, and manage the overall network system.

- f) These professionals have strong leadership and managerial skills, excellent communicators, and able to quickly think seriously and reasonably.
- g) They solve any technological problem, and therefore troubleshoot quickly and effectively, and are to work under stressful circumstances and deadlines.

2. Computer Scientist

- a) The term computer scientist applies to a person who can perform a wide range of jobs in information technology and related fields.
- b) A computer scientist often uses current forms of technology, or creates new ones, in order to solve complex problems, thus applying information technology principles to real-world situations.
- c) Computer scientists work as robotics researchers, hardware designers, software engineers, technology consultants, and systems analysts for universities, government organizations, and private corporations.
- d) Computer scientists help companies to maintain proper air traffic flow in the skies above our cities.
- e) Computer scientists' help shipping companies distribute goods to ports around the world.

3. Computer Support Specialist

- a) A computer support specialist assists people when they are having technical trouble with their computers. It is their responsibility to identify any technological problems and then try to fix them.

- b) Because most of the computer problems can be solved via e-mail or by phone, all computer support specialists need to possess excellent communication and explanatory skills as they need to be able to give step-by-step directions so customers can solve the problems themselves.
- c) Computer support specialists are also usually responsible for installing everything from software, printers, Wi-Fi, and other computer tools and components.
- d) Once installed, they also teach customers how to properly use the new devices and even write instructional handbooks.
- e) They check company's computer systems every day to ensure they are operating correctly or working for a school and assisting other teachers and administrators who are having computer issues.
- f) Most of their work consists of dealing with people who are not as technologically inclined as they are and it's important that they remember this and be patient when customers do not understand how to correct the issue the first time.

4. Computer Systems Analyst

- a) Computer systems analysts are responsible for using their information technology skills to help different businesses and organizations operate at maximum potential.
- b) Systems analysts usually start an assignment by first consulting with the company's managers, discussing what the old systems flaws are and what the new system should do.
- c) The analysts formulate a plan and design (or perfect) systems that will help the company achieve their goals. For example, a large

retail store or food corporation might want a systems analyst to create a new computerized inventory system.

- d) The analyst is responsible for specifying all the details from beginning to end when configuring a new system; including determining if the system is economically possible.
- e) He configures all hardware and software components, creating flow charts describing the systems progress during the initial developmental stages and experimenting with the system repeatedly to ensure it works properly at the end.
- f) They apply knowledge in structured analysis, data modeling, information engineering, mathematical model building, sampling, and accounting principles.

5. Computer Systems Designer

- a) Those who work in computer systems design create computer and IT systems that allow businesses and other entities to operate effectively and efficiently.
- b) As a computer systems designer, you will facilitate these computer and IT systems, working to design custom software programs, manage computer and information systems, as well as manage computer facilities.
- c) Your work may be done onsite for one particular company, or you might do your work on a contract basis for several organizations.
- d) Some computer systems designers specialize in a particular service, like websites, e-commerce, and data centers. Information security has become a growing concern for organizations, and computer systems designers are increasingly being used to manage these threats.

- e) Computer systems designers will typically work a regular full time week in business office settings.
- f) However, some may work in computer operations centers if they specialize in facilities management and maintenance, and others are able to work from home or other remote locations.

6. Computer Programmer

- a) Computer programmers often work with software engineers to convert a newly designed application into functional computer code so that the computer can understand the instructions and run the program.
- b) Essentially, computer programmers implement the designs of software engineers, using programming languages such as C++ to write the program so that it runs efficiently.
- c) Computer programmers also maintain and update already existing applications.
- d) They can repair buggy programs.
- e) They often make use of computer-assisted engineering tools in their work, which help automate some of the programming process, thus allowing computer programmers to focus on the more intricate aspects of the process.
- f) Many computer programmers have begun working more as software engineers, or as assistants to software engineers, helping clients identify their needs and problems and working to provide effective software solutions.

7. Database Administrator

- a) Database administrators are responsible for handling the information stored on the computer databases of various businesses and organizations.
- b) They come up with effective ways of storing, organizing, analyzing, using and presenting this data.
- c) Database administrators are usually skilled in using database management software.
- d) Some database administrators are charged with integrating data from old, outdated computer systems to new, more efficient systems.
- e) When a database administrator decides that a change needs to be made to a company's database, he must test any modifications and make sure no glitches occur or data is lost.
- f) Every day, these professionals must demonstrate a thorough understanding of database systems and know the factors that affect the performance of that system.
- g) They often work closely with network administrators to devise security measures to protect private company information, as many databases are connected to the Internet.
- h) Some database administrators even participate in the design of databases.

8. Network Administrator

- a) Network administrators are responsible for building, maintaining, managing, and repairing an organization's computer networks.

- b) Network administrators handle a company's Local Area Networks (LANs), Wide Area Networks (WANs) and network segments, as well as manage the company's Internet and intranet systems.
- c) They must install and maintain hardware and software that supports an organization's networks, making sure everything is working the way it is supposed to be.
- d) Network administrators keep a sharp eye on network performance, taking steps to ensure user's needs are being met and repairing any problems that crop up.
- e) Network security is also a vital component of a network administrator's work, as they must establish a means of protecting the organization's networks from hackers and other threats.

9. Network System Analyst

- a) A network system analyst is an expert in the relationship between computers and various networks, like local area networks (LAN), wide area networks (WAN), the Internet, intranets and other communications systems.
- b) They design and implement networks according to their clients' specific business and telecommunications needs.
- c) They should also be familiar with all hardware and software components related to networks, as they will also assist in the upgrading and maintenance of the systems.
- d) These professionals can also manage and supervise other Information Technology (IT) team members, like computer programmers or web designers.

- e) Network system analysts should be able to think on their feet, stay side by side of the latest industry developments, and be excellent communicators.
- f) They should also be able to think seriously, as they will often be called upon to troubleshoot network problems.

10. Software Engineer

- a) Software engineers create and develop all kinds of software programs, such as video games, computer operating systems, network systems, business applications, and so on.
- b) They design and engineer programs that can work within hardware limitations and still provide the best interface experience according to the needs of the user.
- c) Based on the user's needs, software engineers construct and test various version of an application.
- d) Once a test is successful, they then engineer the program, implement it to the user's specifications, and maintain it for the user if needed.
- e) Software engineers can set up companies' programs to respond directly to that company's needs. For example, a sales and marketing company might hire software engineers to develop, construct, and maintain a specific sales application, which could track accounts and log sales, so its employees could better interact with potential clients.

Preparing for a career in the computer industry

There are many career opportunities in the computer industry. It is important for one to consider taking up subjects that are essential like

Maths, Physics since many professional courses rotate around this. Other career opportunities do not need any bias in Maths and Physics like working as an internet café attendant. One therefore needs to prepare appropriately depending on the career one chooses.

Review questions:

1. Write five roles of the following:
 - a) Computer and information system manager.
 - b) Computer scientists.
 - c) Computer support specialist.
 - d) System analyst.
 - e) System designer.
 - f) Computer programmer.
 - g) Database administrator.
 - h) Network administrator.
 - i) Network system analyst.
 - j) Software engineer.

GREEN COMPUTING

Green computing is defined in many ways that include:

1. Refers to the creation of environmentally sustainable computing or IT.
2. 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.

The goals of green computing are:

1. To reduce the use of hazardous materials,
2. To maximize energy efficiency during the product's lifetime,
3. To promote the recyclability or biodegradability of defunct products and factory waste.

Many corporate IT departments have Green Computing initiatives to reduce the environmental impacts of their IT operations. Research continues into key areas such as making the use of computers as energy-efficient as possible, and designing algorithms and systems for efficiency-related computer technologies.

Software and deployment optimization

The efficiency of algorithms has an impact on the amount of computer resources required for any given computing purpose. Algorithm changes, such as switching from a slow (e.g. linear) search algorithm to a fast (e.g. hashed or indexed) search algorithm can reduce resource usage for a given task from considerable too close to zero.

Resource allocation

Algorithms can also be used to direct data to data centers where electricity is less expensive. Researchers from MIT, Carnegie Mellon University, and Akamai have tested an energy allocation algorithm that successfully routes traffic to the location with the cheapest energy costs.

A similar approach has also been used to cut energy usage by routing traffic away from data centers experiencing warm weather; this allows computers to be shut down to avoid using air conditioning.

Virtualizing

Computer virtualization refers to the idea of computer resources, such as the process of running two or more logical computer systems on one set of physical hardware.

With virtualization, a system administrator could combine several physical systems into virtual machines on one single, powerful system, thereby unplugging the original hardware and reducing power and cooling consumption. Virtualization can assist in distributing work so that servers are either busy or put in a low-power sleep state.

Terminal servers

Terminal servers have also been used in green computing. When using the system, users at a terminal connect to a central server; all of the actual computing is done on the server, but the end user experiences the operating system on the terminal. These can be combined with thin clients, which use up to 1/8 the amount of energy of a normal workstation, resulting in a decrease of energy costs and consumption. There has been an increase in using terminal services with thin clients to create virtual labs. Examples of terminal server

software include Terminal Services for Windows and the Linux Terminal Server Project (LTSP) for the Linux operating system.

Power management

The Advanced Configuration and Power Interface (ACPI), an open industry standard, allows an operating system to directly control the power-saving aspects of its basic hardware. This allows a system to automatically turn off components such as monitors and hard drives after set periods of inactivity.

In addition, a system may hibernate, where most components (including the CPU and the system RAM) are turned off. ACPI is a successor to an earlier Intel-Microsoft standard called Advanced Power Management, which allows a computer's BIOS to control power management functions.

Data center power

Data centers, which have been criticized for their particularly high energy demand, are a primary focus for green computing. Data centers can improve their energy and space efficiency through techniques such as storage consolidation and virtualization.

Operating system support

The leading desktop operating system, Microsoft Windows, has included limited PC power management features since Windows 95. These initially provided for stand-by (suspend-to-RAM) and a monitor low power state.

Windows added hibernate (suspend-to-disk) and support for the ACPI standard. Windows 2000 was the first NT-based operating system to include power management.

Power supply

Desktop computer power supplies (PSUs) are in general 70–75% efficient, dissolve the remaining energy as heat. A certification program called 80 Plus certifies PSUs that are at least 80% efficient; typically these models are drop-in replacements for older, less efficient PSUs of the same form factor.

Storage

Smaller form factor (e.g., 2.5 inch) hard disk drives often consume less power per gigabyte than physically larger drives. Unlike hard disk drives, solid-state drives store data in flash memory or DRAM. With no moving parts, power consumption may be reduced somewhat for low-capacity flash-based devices.

As hard drive prices have fallen, storage firms have tended to increase in capacity to make more data available online. This includes archival and backup data that would formerly have been saved on tape or other offline storage. The increase in online storage has increased power consumption. Reducing the power consumed by large storage arrays, while still providing the benefits of online storage, is a subject of ongoing research. An example is **sky drive** and **drop box** respectively.

Video card

A fast GPU may be the largest power consumer in a computer. Energy - efficient display options include:

4. No video card - use a shared terminal, shared thin client, or desktop sharing software if display required.
5. Use motherboard video output - typically low 3D performance and low power.

6. Select a GPU based on low idle power, average wattage, or performance per watt.

Display

CRT monitors typically use more power than LCD monitors. They also contain large amounts of lead. LCD monitors typically use a cold-cathode fluorescent bulb to provide light for the display. Some newer displays use an array of light-emitting diodes (LEDs) in place of the fluorescent bulb, which reduces the amount of electricity used by the display. Fluorescent back-lights also contain mercury, whereas LED back-lights do not.

Materials recycling

Recycling computing equipment can keep harmful materials such as lead, mercury, and hexavalent chromium out of landfills, and can also replace equipment that otherwise would need to be manufactured, saving further energy and emissions. Computer systems that have outlived their particular function can be re-purposed, or donated to various charities and non-profit organizations.

Telecommuting

Teleconferencing and telepresence technologies are often implemented in green computing initiatives. The advantages are many;

1. Increased worker satisfaction,
2. Reduction of greenhouse gas emissions related to travel, and
3. Increased profit margins as a result of lower overhead costs for office space, heat, lighting, etc.

Other related initiatives, such as hotelling reduce the square footage per employee as workers reserve space only when they need it. Many types of jobs, such as sales, consulting, and field service, integrate

well with this technique. Voice over IP (VoIP) reduces the telephony wiring infrastructure by sharing the existing Ethernet copper. VoIP and phone extension mobility also made hot desking more practical.

Review questions:

1. (a). Define the term ‘Green Computing’.
- (b). State two goals of Green Computing.
- (c). Explain the following in relation to Green Computing:
 - i.) Software and deployment optimization.
 - ii.) Resource allocation.
 - iii.) Virtualization.
 - iv.) Terminal servers.
 - v.) Power management.
 - vi.) Data center power.
 - vii.) Operating system support.
 - viii.) Power supply.
 - ix.) Storage.
 - x.) Video card.
 - xi.) Material recycling.
 - xii.) Telecommuting.

2. COMPUTER CERTIFICATION

Professional certifications in computer technology are non-degree awards made to those who have achieved qualifications specified by a certifying authority. Depending on the particular certification, qualifications may include completing a course of study, proof of professional accomplishments, achieving a specified grade on an examination or some combination thereof. The intention is to establish that an individual holding a certification is technically qualified to hold certain types of position within the field.

Certifications, generally, need to be renewed periodically, or may be valid for a specific period (e.g. the lifetime of the product upon which the individual is certified). As a part of a complete renewal of an individual's certification, it is common for the individual to show evidence of continual learning — often termed continuing education — or earning continuing education units (CEU). Certification is often used in the professions of information technology industry.

Some certification programs are tilting toward specific technologies, and are managed by the vendors of these technologies. These certification programs are tailored to the institutions that would employ people who use these technologies.

1. Vendor-specific certifications

- ✓ Apple Inc. sponsors the Apple certification program.
- ✓ ARM Holdings sponsors the ARM Accredited Engineer program.
- ✓ Avaya sponsors the Avaya Professional Credential Program.
- ✓ Cisco Systems sponsors the Cisco Career Certifications program.
- ✓ Brocade Communications Systems sponsors the Brocade Certification and Accreditation program.
- ✓ Citrix Systems sponsors the Citrix Certified Administrator program.

- ✓ Cyberoam sponsors the Cyberoam Security certifications program.
- ✓ Hewlett-Packard sponsors the HP ExpertONE certification program.
- ✓ Dell sponsors the Dell Certified Systems Expert program with Associate and Master levels.
- ✓ IBM sponsors certifications.
- ✓ ISIS Papyrus sponsors the Papyrus Certified Professionals Program.
- ✓ Juniper Networks sponsors the Juniper Networks Technical Certification Program.
- ✓ LANDesk sponsors the Certified LANDesk Administrator and Certified LANDesk Engineer program.
- ✓ Microsoft Corporation sponsors the Microsoft Certified Professional program.
- ✓ MySQL (as part of Oracle now) sponsors a certification program.
- ✓ National Instruments offers certifications in Lab VIEW, TestStand, and LabWindows/CVI software.
- ✓ Nortel sponsors the Nortel Certifications program.
- ✓ Novell sponsors a certification program.
- ✓ Object Management Group sponsors the Certified Professional program for the Unified Modeling Language.
- ✓ Oracle Corporation sponsors the Oracle Certification Program.
- ✓ Red Hat sponsors the Red Hat Certification Program
- ✓ SAP sponsors individual training and certifications
- ✓ SAS sponsors a certification program
- ✓ SolarWinds sponsors the SolarWinds Certified Professional Program for network management
- ✓ SpringSource sponsors the SpringSource Certified Professional program.
- ✓ Sun Microsystems sponsors the Sun Certified Professional program (now part of the Oracle Certification Program)
- ✓ Sybase sponsors the Certified Sybase Professional program
- ✓ Ubuntu, provides Ubuntu Certified Professional program
- ✓ VMware sponsors certification programs (VCP & VCDX)

- ✓ Zend Technologies sponsors the Zend Certified Engineer (PHP) program.

2. Third-party and vendor-neutral certifications

Third-party commercial organizations, trade associations, and vendor-neutral interest groups that sponsor certifications include:

- ✓ SCIPP International ANSI Accredited Secure Web-Application Development Awareness course and End-User Security Awareness courses.
- ✓ MigrationX sponsors unique IT migration related certifications like Certified Migration Expert (CME) & Certified Migration Professional (CMP).
- ✓ The BSD Certification Group Inc. A non-profit organization committed to creating and maintaining a global certification standard for system administration on BSD based operating systems.
- ✓ INFINIDOX sponsors 4 professional information security certifications.
- ✓ Basic Computer Literacy Certification
- ✓ Certiport sponsors the Microsoft Office Specialist and IC3 certification (Internet and Computing Core).
- ✓ CompTIA (Computing Technology Industry Association) CompTIA offers 12 professional IT Certifications, validating foundation-level IT knowledge and skills.
- ✓ ECDL Foundation sponsors the European Computer Driving Licence (also called International Computer Driving Licence) (ICDL)
- ✓ International Information and Communication Technology Council Certification Program
- ✓ (ISC)² sponsors the CISSP, SSCP and other security certifications
- ✓ Learning Tree International sponsors Learning Tree Professional Certification.
- ✓ Linux Professional Institute

- ✓ Majinate sponsors the Accredited Symbian Developer scheme for Symbian OS
- ✓ NACSE (National Association of Communication Systems Engineers) sponsors 36 Vendor Neutral, knowledge specific, Certifications covering the 5 major IT Disciplines which are: Data Networking, Telecomm, Web Design & Development, Programming & Business Skills for IT Professionals.
- ✓ Network Professional Association offers the Certified Network Professional program
- ✓ The Open Group sponsors TOGAF certification and the IT Architect Certification (ITAC) and IT Specialist Certification (ITSC) skills and experience based IT certifications.
- ✓ Planet3 Wireless sponsors the Certified Wireless Network Administrator (CWNA) certification SAGE (organization) sponsors the SAGE program
- ✓ SANS Institute operates the Global Information Assurance Certification program.
- ✓ Storage Networking Industry Association (SNIA) sponsors the SNIA Certification Program.
- ✓ The SolidQ University Certifications
- ✓ Testout offers the PC Pro Certification and the Network Pro Certification with its CompTIA A+ and Network+ course material. Validated Guru provides the Certified Software Developer (VGCSO) certification. The exam is free (\$0), Certificate and Validation Services optional.
- ✓ Eipass.

3. General certification

General certification of software practitioners has struggled. The ACM had a professional certification program in the early 1980s, which was discontinued due to lack of interest. Today, the IEEE is certifying software professionals, but only about 500 people have passed the exam by March 2005.

- ✓ The IEEE Computer Society sponsors the Certified Software Development Professional as well as membership designations, "Senior" and "Fellow" which reflect experience and peer review qualification.
- ✓ The IET sponsors the Chartered Engineer and Incorporated Engineer, which can be ratified into the European Engineer
- ✓ The BCS sponsors the Chartered IT Professional (CITP) programme.
- ✓ The Institute for Certification of Computing Professionals sponsors the Certified Computing Professional (CCP) and Associate Computing Professional (ACP) certifications
- ✓ The BDPA IT Institute sponsors the BDPA IT Associate (BITA), the BDPA IT Professional (BITP), and the BDPA IT Master (BITM) certifications
- ✓ The Canadian Information Processing Society sponsors the Information Systems Professional (ISP) and Information Technology Certified Professional (ITCP) in Canada.
- ✓ The American Institute of Certified Public Accountants sponsors the Certified Information Technology Professional program.
- ✓ APICS establishes operations management standards and sponsors certification for Logistics.
- ✓ The New Zealand Computer Society sponsors the Information Technology Certified Professional programme
- ✓ The Australian Computer Society offers pathways to Certified Professional (CP) and Certified Technologist (CT) designation.
- ✓ The Canadian Council of Technicians and Technologists sponsors the Certified Engineering Technologist or Professional Technologist Information Technology or Electronics (Computer) Technology profiles.

4. Green computing certifications

Some certifications demonstrate that an individual has specific green computing knowledge, including:

- ✓ Green Computing Initiative - GCI offers the Certified Green Computing User Specialist (CGCUS), Certified Green Computing Architect (CGCA) and Certified Green Computing Professional (CGCP) certifications.
- ✓ CompTIA Strata Green IT is designed for IT managers to show that they have good knowledge of green IT practices and methods and why it is important to incorporate them into an organization.
- ✓ Information Systems Examination Board (ISEB) Foundation Certificate in Green IT is appropriate for showing an overall understanding and awareness of green computing and where its implementation can be beneficial.
- ✓ Singapore Infocom Technology Federation (SiTF) Singapore Certified Green IT Professional is an industry endorsed professional level certification offered with SiTF authorized training partners. Certification requires completion of a four day instructor-led core course, plus a one day elective from an authorized vendor.
- ✓ Australian Computer Society (ACS) The ACS offers a certificate for "Green Technology Strategies" as part of the Computer Professional Education Program (CPEP). Award of a certificate requires completion of a 12 week e-learning course designed by Tom Worthington, with written assignments.