NETWORKING

network |ˈnɛtwəːk|

noun

1 an arrangement of intersecting horizontal and vertical lines. *a spider constructs a complex network of several different kinds of threads.*

2• a system of connected electrical conductors.

WHY NETWORK COMPUTERS?

Joining computers together, either with cabling such as ethernet or wirelessly can be complex, so why do we do it? There are many reasons why we would want to network computer together. The main reason is to share. This may be to share files and data, or a resources like a printer or a connection to the Internet.

TYPE OF NETWORK

There are different types of computer network. They can be defined by the relationship the computers have with each other and the way they are joined together. We will look first at the relationship between each computer.

Peer to Peer

All stations are joined together in the network have equal status. If you have a number of computers at home on sharing a wireless router then this is the type of network you will probably have. Each device shares the connection to the Internet, whether that is a tablet, games console or computer. You may have other shared resources like a printer or even a media server. You may be able to get access to your media server through your tablet or games console, to stream music or video on to your TV.

So in a peer to peer network, there is no central computer or data store. You may be able to share data from one computer to another. This needs to be set up on each device and is not done centrally.

Applications may be stored on different computers and accessed by all as longer as the owner gives permission. Work is backed up on individual user PCs.

In a peer to peer network you get the benefit of being able to share resources but each computer must be set up individually. This is fine for the home but becomes inefficient the more computers you have.

Client-Server Network

A client-server network has different types of computers. A powerful central computer called a server manages the client computers the users use. The data is stored centrally. This means that it does not matter which client computer the user logs on to they can still access all their work.

In a client server network, the client computers can be managed centrally from the server. This means that installation of programs, back ups, security and access rights can all be managed from one place. This can save a great deal of time. However this does mean there is a reliance of this central computer. If the server goes down then no-one can access anything. Also it is more technically challenging to set up and maintain such a network. This means there is often someone responsible for managing the computer. For large networks this is the most efficient and flexible despite the reliance on the central computers. Effort is taken to make sure this central computer is always backed up and working properly.

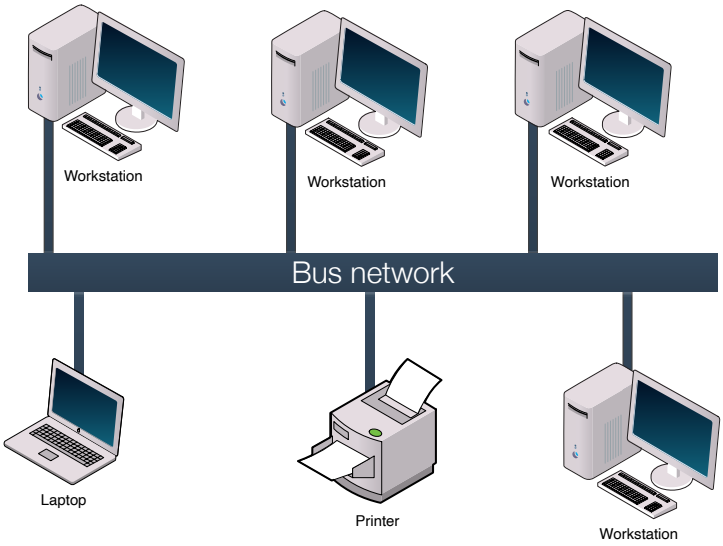
Complete the table to summarise the differences between networks.

Peer to Peer	Client Server

TOPOLOGY

Computers can be joined together in different ways. The way they are joined together is known as topology. There are three main network topologies that we need to be aware of.

BUS NETWORK

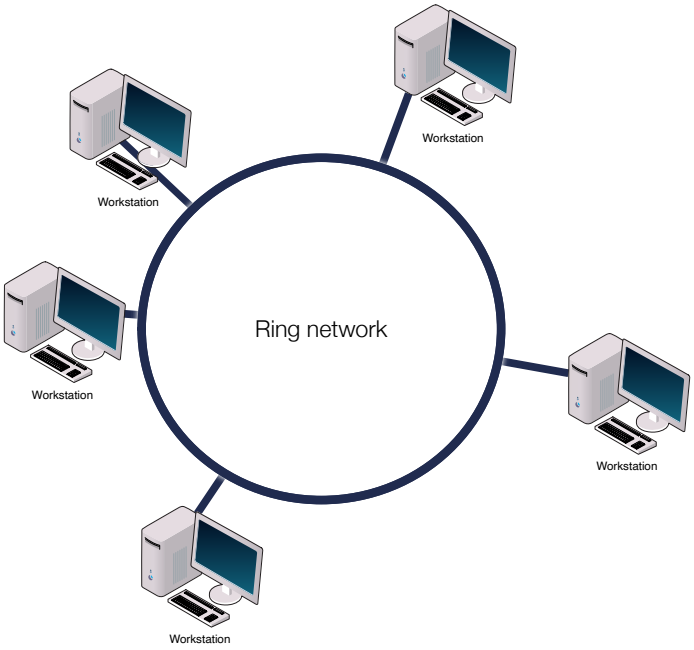


Description

Advantages

Disadvantages

RING NETWORK

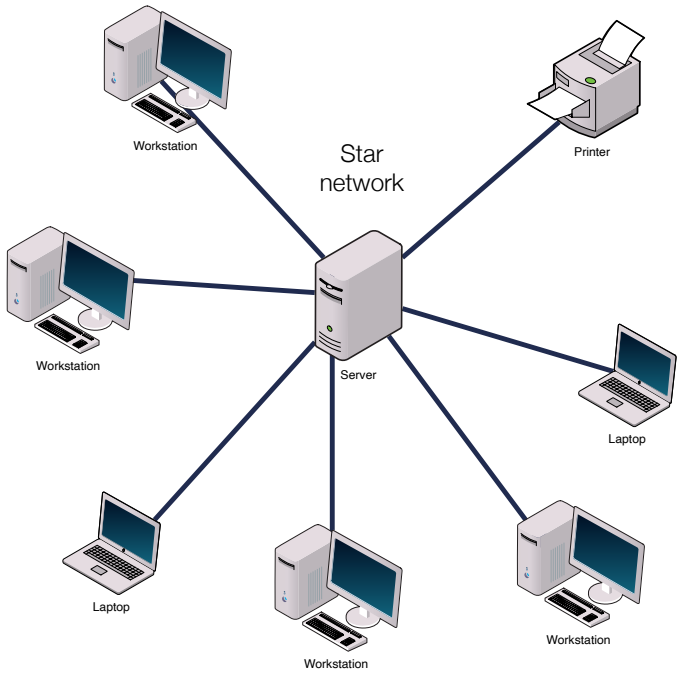


Description

Advantages

Disadvantages

STAR NETWORK



Description

Advantages

Disadvantages

LOCAL AREA NETWORKS AND WIDE AREA NETWORKS

As well as being able to describe a network based on its topology, we can also describe a network in terms of geography.

A Local Area Network (LAN) is a network that is on one geographical location. This may be just one room of computers or as big as a single site, covering a number of buildings. The computers are all connected together through wiring such as ethernet, fibre optic or wireless LAN.
Some large organisations have more than one site, but still need to communicate between sites. These separate LANs are joined together through the telephone networks to create a Wide Area Network or WAN. The Internet is the biggest WAN, joining together millions of computers.

ADDRESSING

Each computer on a network needs to be uniquely identified so that data can be sent and received from it. There are many different ways of doing this.

Protocols are used to help control network communication. Protocols are a set of rules that all the devices on a network must follow if they are to be able to communicate with each other.
When connected to a network or the Internet each computer will have an Internet Protocol address or **IP** address. This is made up of 4 bytes. We often see this as a series of 4 numbers ranging from 0-255 separated by full stops. So 10.1.128.240 is an example of an IP address. Computers use these addresses to communicate with each other in the same way we use phone numbers.
These numbers are hard for people to remember, so on the Internet each IP address of a website has a domain name, a text based name that is easier to remember. See the next section for more details.

As well as IP addresses, each network interface in a computer (ethernet card or wifi card) also has a unique Media Access Control address or MAC address. Each device usually has this address hardwired into them when they are manufactured. Again these addresses help a network identify each device, making sure that data travels to the correct destination.

PACKETS AND PROTOCOLS

Imagine you are an author and you have written a 500 page manuscript which must be sent by post. The problem is that due to the postal charges, you can only send 50 pages at a time.

How do you get the manuscript to your publishers, so they can assemble it correctly?

Firstly you would split your document into 50 page sections, putting each into an envelope. On the envelope you would put the publisher's address as well as your own address, so they know who sent it. You would also need to label each envelope so that the publisher know which set of pages were in each. So the first one would be labelled packet 1/10 pages 1-50, the second packet 2/10 pages 51-100 etc. Then the envelopes could be posted and the publisher knows from the envelopes how to reassemble to manuscript. It does not matter if the envelopes do not arrive in order. If one goes missing, the publisher can figure out which one it is and ask for a replacement.

This is how data gets sent around networks.

Use the following terms to explain how data gets sent from one computer to another.

APPLICATION, PACKET, IP ADDRESS, PROTOCOL, SWITCHES

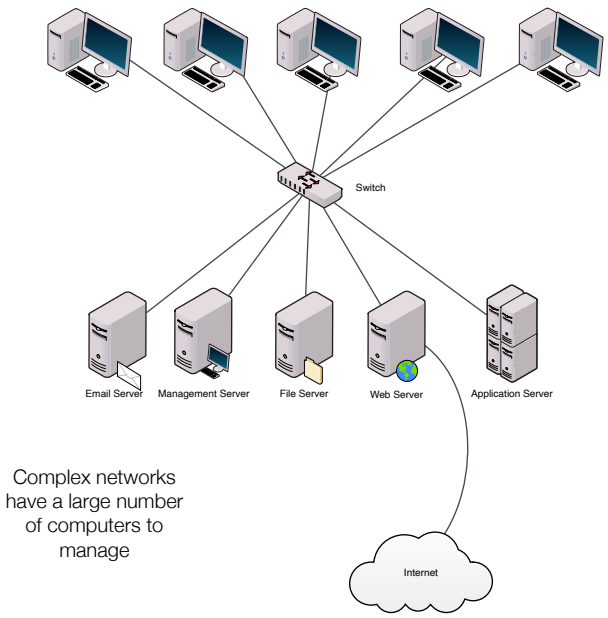
SECURITY ON NETWORKS

When we have so many users on a network, security becomes a big issue. In big companies and organisations, while they often want to be able to access data from any computer on their network, it does not mean that every employee should have the same access to all the data and programs.

How does a network manager make sure that their network is kept secure?

MANAGING A NETWORK

A computer network needs a great deal of effort to manage and keep it running smoothly. Computer networks often have A network manager who has a number of responsibilities.



Complex networks have a large number of computers to manage

Each user often has just signed an acceptable use policy. This document in forms the users have a network can be used in an acceptable way. This may be different for each organisation. For example some companies may prohibit the use of USB memory sticks, as they may be a source of viruses and other malware as well as be a device to steal sensitive documents. An acceptable use policy would also cover the use of the Internet. Internet use in a company is often monitored and any unacceptable use could result in the employee being disciplined or even sacked.

Another task needs to be completed is that of archiving and backing up of data. Computer hardware like hard disks can fail. This would result in the loss of all the data that was on the disk. Backing up means copying that data onto another storage medium such as another hard disk, a tape or the cloud. If I hard disk was to fail and data could be restored from the backup onto a new hard disk.

Explain Grandfather, Father, Son backup procedures.

THE INTERNET

The Internet is an enormous network of networks. Today almost a third of the entire Earth's population uses the Internet. We get access to the Internet through Internet Service Providers or ISPs. These companies attach to the Internet proper. We connect with them through fixed line or mobile phone networks. The Internet is uses a number of technologies to transfer data. Email, World Wide Web, File Transfer, Messaging all use the Internet.

The services that make up the Internet, such as the World Wide Web, are hosted on thousands of computers all over the world. Special servers allow access to data and transfer this from server to computer. The world wide web for example is hosted on web servers by a variety of web hosting companies and private companies. These web servers host the webpages and other files that people want to view.

When you browse the Internet using a web browser, a number of things happen when you request a page. Normally when we request a page we type in a web address or click on a hyperlink to an address. For example if we clicked on a link to http://www.bbc.co.uk your web browser is making a request to that computer. Computers however don't have names, they are identified by numbers known as **IP addresses**. These addresses are stored on special servers called **Domain Name Service** servers. These are a little like telephone directories. The name of the website is looked up in one of the **DNS** servers and finds out the IP address of the web host. The message then gets passed on to that server at the BBC. The web server understands that a web page has been asked for. It then sends this page back to the computer that asked for it.

The Internet is often described as a Mesh topology. Draw a mesh network. What are the advantages of a mesh network?

WEB PAGES

There are billions of web pages on the Internet. These pages are all written in a special language called Hypertext Markup Language (HTML).

HTML is the language of the World Wide Web. Every web page that you have looked at is written in this language. HTML is a text based language that tells the web browser (Internet Explorer, Google Chrome and the like) how to display the page.

HTML is made up of tags that describe to the web browser how to display the web page. Tags are surrounded by less than and greater than signs, < tag >.
Tags generally come in pairs. One tag opens the formatting and the closing tag ends the formatting. A closing tag has a slash (/) to show that it is a closing tag.

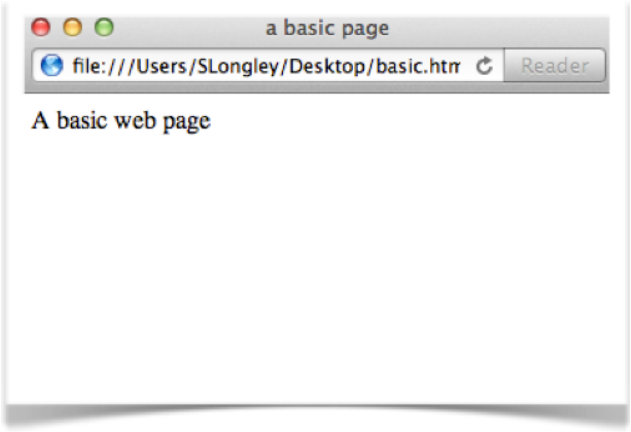
TAGS

All web pages start with a <html> tag and end with the closing </html> tag. This tells the web browser that the page is a web page.

Web pages are divided into two sections. The head section contains information that is not displayed in the main browser window. This is often JavaScript code that can make the page interactive or style information that can make a page look more colourful. The next section is the body section. Everything in this section is displayed inside the browser window.

A basic web page.

```
<html>
<head>
<title>a basic page</title>
</head>
<body>
A basic web page
</body>
</html>
```



Tag	Description
<h1> .. <h6>	Headings 1 - 6. This tag make text look bold. <h1> is a large heading while <h6> is a very small heading
<a>	
<table>	
<tr>	
<td>	
<form>	
<input>	
<img>	

TAG ATTRIBUTES

Many tags have attributes. These are keywords followed by a value in quotes.
Eg:
<table width="70%">

The table tag has a width attribute that is set to 70%. This means the table is 70% of the browser window. A common attribute is a tag's id. This can be used by JavaScript to select a tag to change it.

CSS

Another web technology is cascading style sheets or CSS. These help provide more style information as to how the browser displays the content. CSS cover things like colours and borders and helps with organising the layout of the content. Often one style sheet can be used to style a series of pages giving them a similar appearance.

Changing a style sheet can be used to dramatically change the appearance of a web page without actually changing the underlying HTML code. This means that web designers can keep their websites looking fresh without having to rewrite all their web pages and often by only altering one style sheet.

JAVASCRIPT

To make web pages interactive a programming language must be used. JavaScript is a script based interpreted language that can be embedded in webpages to allow for interactivity and animation. A combination of HTML, CSS and JavaScript can be used to create complex interactive websites and even games. A version of Angry Birds and Cut the Rope is playable online and all programmed using HTML, CSS and JavaScript.

Javascript is often used to validate forms. This prevents data that is not sensible or acceptable from being submitted to websites for processing.

What types of validation would a car insurance website want to perform?

FILES OF THE INTERNET

Web pages are pure text files. The HTML, CSS and JavaScript that make up web pages can be viewed using any simple text editor. It is the web browser than converts the tags into the formatting we see when we view a page. So what about things like images, sounds and videos? These files are linked to inside the HTML code. When the web browser finds these links it requests them from the web server and when they have been downloaded, inserts them into the page.

There are some special file formats that have been developed for use on the Internet. Usually these formats are compressed in some way to speed up download times.

File Format	Use
JPG	
GIF	
PNG	
PDF	
MP3	
MPEG	

COMPRESSION

Sending large files over the Internet takes time. Back when most people had dial up modems to connect to the Internet, it was very slow to download a web page, 30 seconds or more for a page with lots of images. Making sure that the image file sizes were small helped to make sure that these download times were as low as possible.

Nowadays most people have broadband and pages generally load pretty fast. However there is an increasing number of people access the Internet on a mobile phone and file sizes not only affect speed of download but also affect peoples data limit.

Compressing a file means finding a way to save the same data into a smaller space. One way to do this is to use an algorithm to search for repeating patterns. In many files there is data that is repeated. Instead of saving all the data multiple times in a file it is just saved once. When the data is repeated a code referring to the data is used instead.

Types of Compression

There are two types of compression, lossless compression and lossy compression.

Explain each type of compression and give examples of the type of file/data that could be compressed using that method and why.

Lossless Compression

Lossy Compression