NETWORK HARDWARE

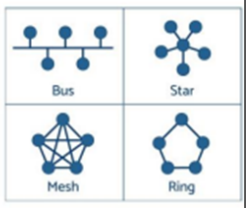
Network Interface Controller (NIC): built in hardware that allows a device to connect to a network.
Switches: connect devices on a LAN
Router: Transmits the data (packets) between the networks (eg: the internet and your LAN)
Wireless Access Point (WAP): a switch that allows devices to connect wirelessly.
Cables: the cables in a network can be twisted pair cables, coaxial cables or fibre optic cables.

NETWORK PERFORMANCE

These factors can impact on network performance:
Bandwidth: The more bandwidth, the more data that can be transferred at a time.
Number of Users: Having a lot of people using a network means lots of data is being transmitted which can slow it down.
Transmission Media: Wired connections are faster than wireless. Fibre optic cables are faster than copper cables.
Wireless Factors: wireless can be affected by walls, distance, signal quality and interference from other devices.

NETWORK TOPOLOGIES

A topology is the layout of a network.



Bus: Slow network due to data collisions on the single backbone cable.
Star: If the central switch fails, the whole network fails. If one device fails, the network is fine.
Ring: Data moves in one direction which prevents collisions. Only one device can send data at once.
Mesh: Each device is connected to every other device so they can send data the fastest route. There is no single point where network can fail. Require lots of wire.

Protocols are the rules for how devices communicate and transmit data across a network. Every device has a **MAC address** so that it can be identified on a network. Eg: 98-1C-B3-09-85-15
IP addresses are used when sending data between networks. They can be static (permanent) or dynamic (different each time the device connects).

TCP/IP:	Used to send data between networks in packets.
Transmission Control Protocol (TCP):	Splits the data into packets and re-assembles. Checks data is sent correctly.
Internet Protocol (IP):	does the packet switching
Hyper Text Transfer Protocol:	(HTTP) for accessing websites HTTPS: The secure version of HTTP
File Transfer Protocol:	(FTP) Moves files between devices
Post Office Protocol (POP3):	Retrieves emails from server. Once you download the email the server copy is deleted.
Internet Message Access Protocol	(IMAP) Retrieves email from server. Email is kept on server, you see a copy.
Simple Mail Transfer Protocol:	(SMTP) sends emails.

Local Area Network	Cover a small geographical area such as an office. Use their own infrastructure.
Wide Area Network (WAN)	WANs connect LANs together over a large geographical area and make use of infrastructure from telecommunications companies.
Bandwidth	The amount of data that can pass between network devices per second
Server	A device that provides services for other devices (e.g. file server or print server)
Client	A computer or workstation that receives information from a central server
Peer to peer Network	All of the computers in the network are equal. They connect directly to each other.
Standalone computers	A computer not connected to a network
Node	A device within a network - e.g. printer, computer, etc.
Topology	The layout of a network can impact on its performance
Virtual Network	Part of a LAN or WAN where only certain devices can "see" and communicate with each other usually connected remotely. These can also be private.

LAYERS

Network protocols are divided into layers so that protocols with similar functions are grouped together.

Layer 4: Application	•Turn data into applications or websites •HTTP, FTP, SMTP
Layer 3: Transport	•Control the flow of data •TCP
Layer 2: Network	•Direct data packets between networks •IP
Layer 1: Data Link	•Sending data over a physical network •Ethernet

Packet Switching - Data is split into packets and numbered in order. Each packet is sent the fastest route across the internet by the routers. This means packets can take different routes and arrive out of order. The packet numbers are used to put them in order. If packets are missing a timeout message is sent. Once all have arrived a receipt confirmation is sent to the device that sent them.

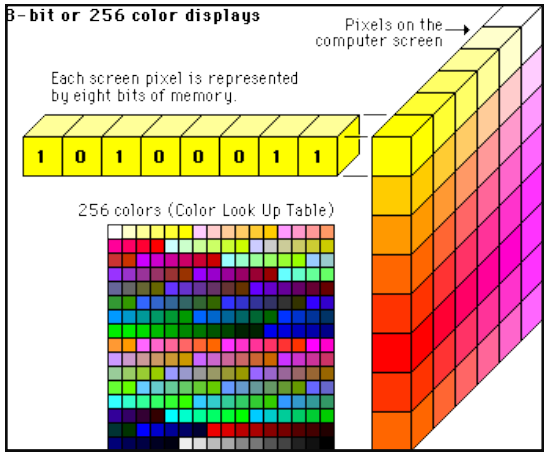
Binary Conversion

The number 42 in binary:

128	64	32	16	8	4	2	1
0	0	1	0	1	0	1	0

Place a 1 in the columns that's are needed in order to make the number you are wanting.

E.g. 32 + 8 + 2 = 42



Binary Addition

Start at the right hand side of any addition and follow the rules.
Here is 7+6 in binary. Note the carries go above the column to the left.

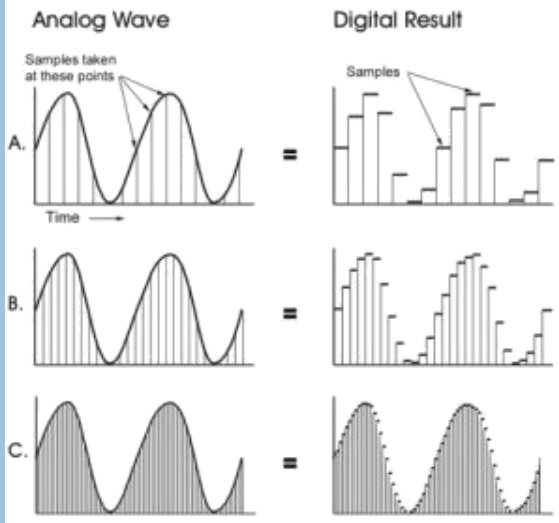
+	=
0+0	0
0+1	1
1+1	0 carry 1
1+1+1	1 carry 1

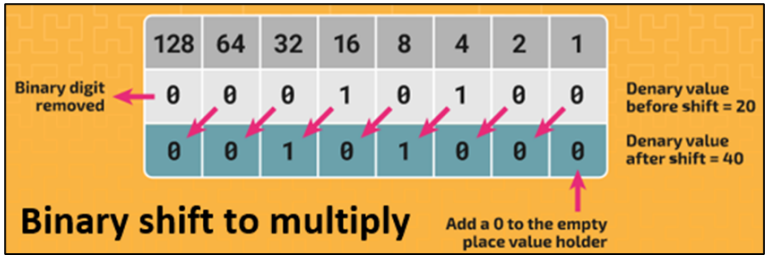
1	1		
0	1	1	1
0	1	1	0
1	1	0	1

Hexadecimal conversion

The hexadecimal number system is 0-9 then A-F (A represents 10)
Carry out a binary conversion then split the number into 2 nibbles. Then convert the two separate values into hexadecimal.
The denary number 42 in Hexadecimal is 2A

128	64	32	16	8	4	2	1
0	0	1	0	1	0	1	0
8	4	2	1	8	4	2	1
0	0	1	0	1	0	1	0
In hex 2 is 2				In hex 10 is A			





ASCII - 128 characters represented—everything on the keyboard. English characters (upper and lower case), numbers and symbols

Unicode - Represents all the characters used in all languages—lot more space needed to store each individual character with a unique binary value

Denary/ Decimal	The number system most commonly used by people. It contains 10 unique digits 0 to 9. Also known as decimal or base 10.
Binary	A number system that contains two symbols, 0 and 1. Also known as base 2.
Hexadecimal	A number system using 16 symbols from 0-9 and A-F, also known as base 16 and hex.
Binary Shift	Multiply a binary number by shifting digits to left. Divide by shifting to the right. Fill gaps with zeros.
Character set	A table of data that links a character to a number. This allows the computer system to convert text into binary. Examples are ASCII and Unicode.
Pixel	Picture element - a single dot of colour in a digital bitmap image or on a computer screen.
Metadata	Data about data, e g photo image files have data about where the photo was taken and which camera took the picture.
Colour Depth	The amount of bits available for colours in an image.
Resolution	The fineness of detail that can be seen in an image - the higher the resolution of an image, the more detail it holds. In computing terms, resolution is measured in dots per inch (dpi).
Sample rate	How many samples of data are taken per second. This is normally measured in hertz, eg an audio file usually uses samples of 44.1 kHz (44,100 audio samples per second).
Bit depth	The number of bits available to store an audio sample.
Duration	Length of a file in terms of time. (minutes and seconds)