

Network and Protocols Revision

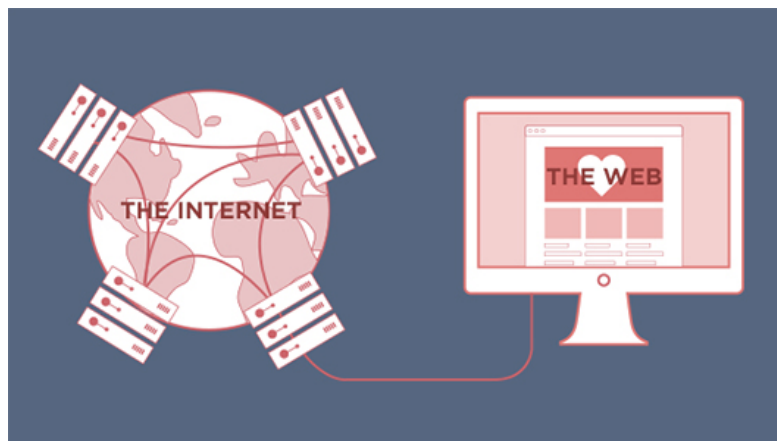
Difference between the internet and the World Wide Web

Most of us use the words web and internet to mean the same thing but they're actually quite different.

The **world wide web**, or web for short, are the pages you see when you're at a device and you're online.

The **internet** is the network of connected computers that the web works on, as well as what emails and files travel across. (Hardware)

The WWW is a service that is made available via the internet.



The WWW works on a **client-server model**. Webpages are stored on web servers and each page has an address known as a **uniform resource locators** or URLs. We tend to call URL's the 'web address'. A web browser is specifically designed to access a website when the user types the URL into the address bar.

Parts of a URL	Parts of the URL in the given example
An example of a URL is https://www.irishtimes.com/sport/soccer/edinson-cavani.....	
Protocol	<i>https</i> is the protocol
Domain name - the name of the website	<i>www.irishtimes.com</i> is the domain name stored on a DNS
An area within that website - like a folder or directory	<i>/sport/soccer</i> is the folder structure leading to where the webpage is located
The webpage name - The page that is being viewed	<i>Edinson-cavani....</i> is the name of the requested webpage

Parts of a URL from left to right

A domain name service (**DNS**) is used to convert the domain name into an **IP address**. It turns a human friendly domain name e.g irishtimes.com into an internet-friendly IP address e.g 182.256.256.2

When a URL is used, the **internet service provider** looks up the domain name using DNS, finds the matching IP address and sends it back to the client.

The web browser sends a request straight to that IP address for the page or file that the user is looking for.

The webpage is sent from the web server to a web browser using the **http** or **https protocol**.

Familiar Protocols		Protocol purpose
HTTP	Hyper text transfer protocol	HTTP is used for transferring data between the client browser (request) and the web server (response) in the hypertext format (Web pages are in hyper text format)
HTTPs	Hyper text transfer protocol secure	HTTPS is abbreviated as Hyper Text Transfer Protocol Secure is a standard protocol to secure the communication among two computers one using the browser and other fetching data from web server. The transferring of data is done in an encrypted format. So it can be said that https thwart hackers from interpretation or modification of data throughout the transfer of packets.
FTP	File transfer protocol	FTP allows users to transfer files from one machine to another. Types of files may include program files, multimedia files, text files, and documents, etc.

Familiar schemes or protocols for accessing the web.

Communication protocols

There are so many different pieces of equipment that could be on a network there must be a set of rules they follow so they can all communicate. When two devices communicate, the client requests access, the server grants it and protocols are agreed. Once this is complete, the data transfer can begin.

Protocols are a standard set of rules that computer systems follow to allow them to communicate and format and process data.

Protocols manage key points about data transfer: Speed of transmission, size of the message, error checking, deciding if transmission is synchronous or asynchronous.

TCP/IP (transmission control protocol / internet protocol)

TCP and IP are two different protocols that are used together to control communication through the internet.

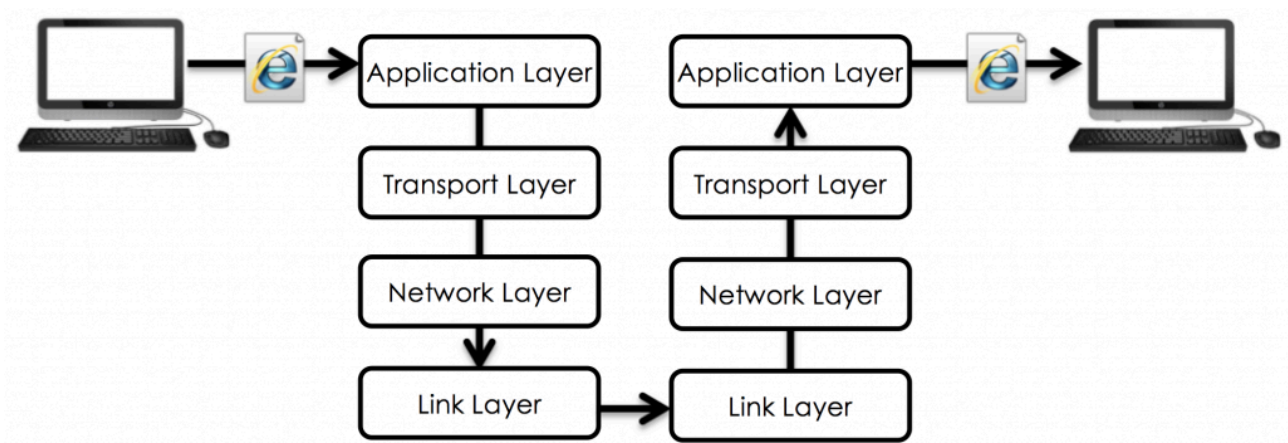
TCP - Transmission Control Protocol	IP - Internet Protocol
Sets the rules for how devices connect to a network	Each device has a unique IP address
Splits the data into packets	This IP address is included in a data packet.
Reassemble the packets at the other end	Manages the addressing of the data packets.
Check data is correctly sent and delivered	Responsible for adding the sender and receiver IP address to each packet.

How it works

- Transmission Control Protocol (TCP) breaks data into equal sized chunks called data packets. Each data packet is given a sequence number and a check digit.
- TCP hands the data packets to the Internet Protocol (IP).
- IP encapsulates each data packet in a wrapper with a header containing the destination IP address and the source IP address.
- IP also routes the data packets across the Internet.
- When they arrive at their destination, TCP takes over again and puts the data packets back together.
- If any are missing or corrupt, TCP will request replacements.

There are four different layers within the **TCP/IP** model and each layer is responsible for different parts of the communication process.

Layer	Function and Protocols in operation
Application Layer	This is where the network applications such as web browsers or email programs operate. It is also where the transfer protocols operate (HTTP, HTTPS,FTP)
Transport Layer	This layer sets up the communication between the devices and they agree on settings such as 'language' and size of the packets. This is where the TCP and UDP protocols operate.
Internet Layer	This layer addresses and packages the data for transmission and routes the packages across the network. This is where the addressing protocol IP operates.
Data link Layer	Physical hardware that connects the devices such as cabling and network interface cards



TCP/IP Layers in action

Other protocols

Layer	Function and Protocols in operation
HTTP - Hyper Text Transfer Protocol	Used by websites to communicate with web servers
HTTPS - HTTP secure	A secure version of HTTP
FTP - File Transfer Protocol	Used to send/receive files to or from a server
SMTP - Simple Mail Transfer Protocol	Used to send emails between servers.
VOIP - Voice Over Internet Protocol	Used to deliver voice and multimedia communications.

Computer Networks

Connecting a number of computers together creates a computer network, these networks can be wired, wireless or a combination of both. When you are using your iPad on the school wifi you are connecting to the schools network.

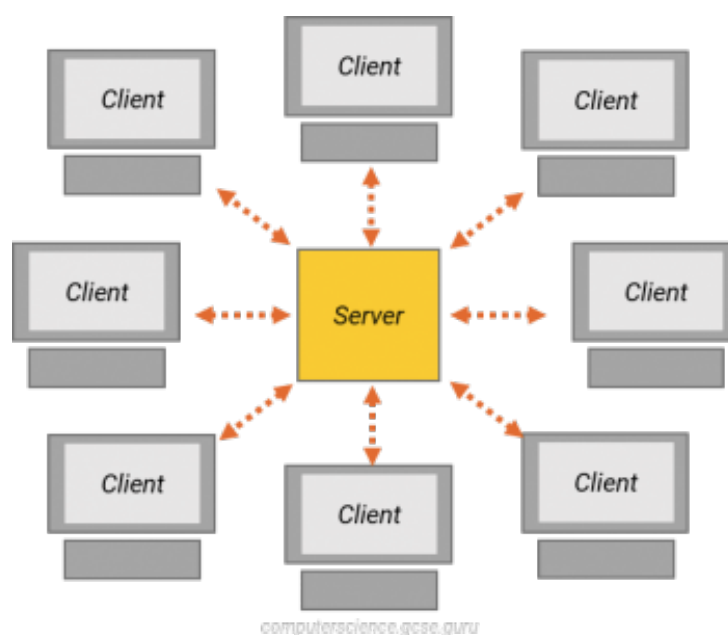
Advantages of a computer network	Disadvantages of a computer network
Share data with other users	Larger networks can be expensive to setup
Access your data from other computers (Think of your schools OneDrive)	Can have security risks
Internet connection can be shared	High amounts of traffic can cause the network to run slowly
Printers can be shared	Depending on the type of network, the entire network could fail if certain elements fail.

Client/Server Networks

In a client/server network, users work at client workstations. A workstation may be a desktop or laptop computer that can connect to the network, for example connecting to the schools network using the schools wifi.

Servers are a dedicated computer system that carry out functions such as storing data, managing/ providing resources and controlling users (clients) access rights. It also acts as a central point on the network that other computers connect too. Users working at client workstations are usually required to log in. The server identifies the users and then allocates the users different levels of access. One or more servers on the network may be responsible for allocating resources such as printing, Internet access, email, file storage etc.

The school network is a client-server network. The server provides staff and students with logons and sets file permissions of what staff and student groups can access. For example the G: Drive contents can be read and edited by staff, but students can only view the contents and not make changes. The software is stored by the server and accessed from the classroom computers via the network.



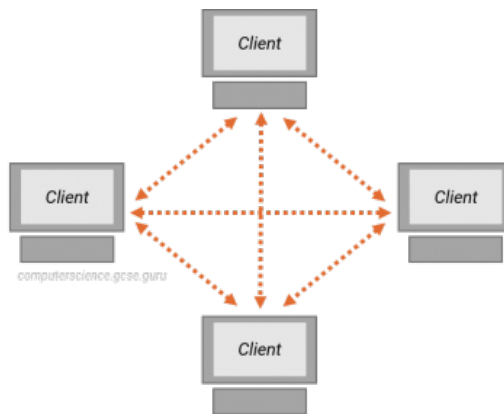
Client-Server Network

Advantages of a client-server network	Disadvantages of a client-server network
More secure than peer to peer networks	Can be expensive to buy and maintain
One client crashing does not effect other clients	Server failure will disrupt all computers on the network
Easier to administrate the whole network using a server	A network technician may be required for maintenance
Individual users do not have to worry about backups or security	

Pros/Cons Client-server network

Peer to peer networks

Peer-to-peer networks are computer networks that do not have a central server controlling the network. Each computer is called a peer, and these peers are connected to one another.
No computer has control over another.



Peer to Peer network

Advantages of a peer to peer network	Disadvantages of a peer to peer network
Users can control which files they want to share or keep private	Each computer needs its own backup system
No cost in buying a server	Potentially less secure when not centralised
Easier and cheaper to setup	Security can be more expensive as each computer needs its own anti-virus etc
Peer failure will only disrupt files being shared from that computer. (unlike a server failure in a server-client network)	Files and resources can be more difficult to share

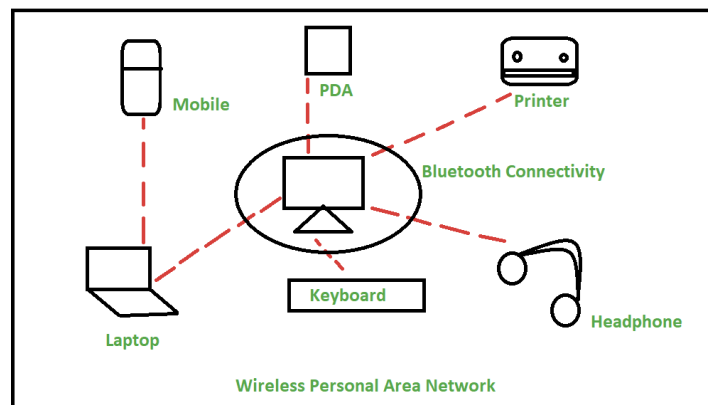
Pros/Cons Client-server network

PANs/ LANs/ WANs

Networks are often classified as either being PANs, LANs or WANs.

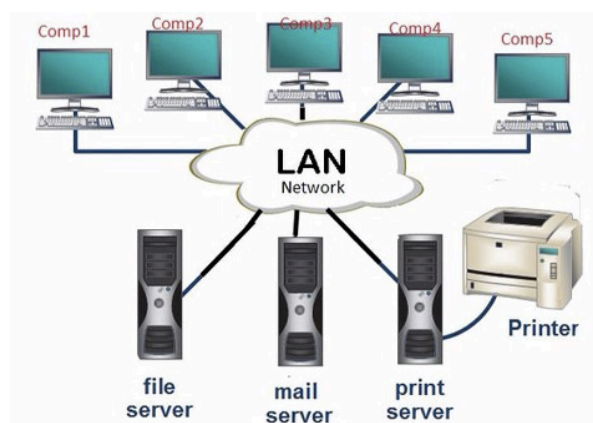
Personal Area Network (PAN)

- A computer network of devices within close distance of an individual and their work space.
- Examples include interconnecting an individual's computer, smartphone and tablet (wired e.g. by USB, or wireless e.g. by Bluetooth)



Local Area Network (LAN)

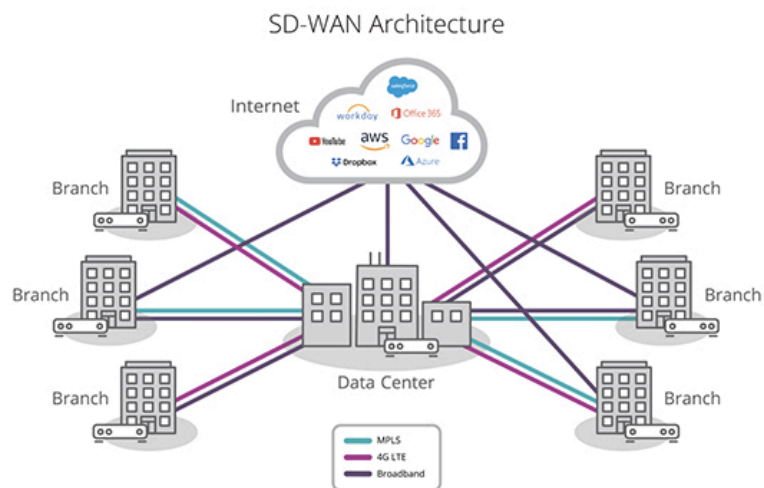
- A computer network that covers a small geographical area.
- Examples include our schools network, small businesses, homes



Wide Area Network (WAN)

- A computer network that covers a large geographical area.
- Examples include multinational companies with offices all over the world, hospitals all over the country sharing patient data, governmental offices, banks.
- WANs can be made up of a number of LANs

Advantages of LAN	Advantages of WAN
Expensive hardware can be shared e.g printers	Covers a large geographical area
Users can access the same files	Share software and resources globally
Single internet connection can be shared	Allows different LANS to connect to each other
Easy to add new systems to the network	Allows users collaborate over huge areas.



Disadvantages of LAN	Disadvantages of WAN
Limited number of systems can be connected before speed of network is affected	Can be expensive to setup
Can't cover a wide area	Need good security to prevent external users joining the network
LAN is only as secure as the weakest node.	Requires a lot of maintenance
Level of maintenance grows as number of users grows	

Cloud Computing

Cloud computing is the use of hardware and software to deliver services over the Internet. This is different to WANs and LANs as you are no longer restricted to an individual network where your work and programs are saved.

Cloud computing allows you to store and access data/programs through the internet which gives the flexibility of working anywhere you can get online.

Services available over the cloud include:

- **Online Data Storage or Infrastructure-as-a-Service (IaaS)** - Services such as storage and processing can be purchased by business. Users can purchase storage space without ever physically having to buy any hardware or maintain it. The cloud provider will backup the users' data to ensure it is never lost.

- **Software Hosting or Software-as-a-Service (SaaS)** - Rather than programs being installed on each computer system, they are installed on the cloud servers and downloaded when needed. The software is managed by a third part provider ensuring your software is always up to date and less technical issues for you to deal with locally.

Cloud computing raises issues about data ownership. Cloud services are useful, but using them means we are sharing our data with service providers. Organisations such as government departments and banks are likely to create their own cloud servers because they have extra restrictions with regards to the data they hold.