

### What is a Computer Network?

A digital telecommunications network which allows nodes (i.e. computers) to share resources.

### Pros and Cons of Networks

**Advantages:**  
**Communication:** becomes easier as a result of technology like texting, emailing, etc.

**Flexibility:** if information is stored on a network, it means users can access it from anywhere in the world.

**Sharing resources:** sharing files and information over a network, including software (can be streamed using web applications) and access to printers.

**Disadvantages:**  
**Hardware:** routers, network cards etc are required to set up a network. This is expensive and requires professional expertise to set up.

**Vulnerability:** hackers can break into networks. Malware can spread and damage files on many computers via a network.

**Dependence:** users relying on a network might be stuck without access to it.

### Wired vs Wireless

#### Wired Networks

The computers are physically connected by wires (e.g. coaxial copper cables, fibre optics). They are arranged in **topologies**.

#### Wireless Networks

There is no physical connection, as radio waves (e.g. in the form of WiFi) are used to communicate data instead.

#### Which is Better?

It is dependent on situation. Wired networks are more reliable, as there is less interference. Security is also easier to manage. However, cabling and other physical components can make it very expensive. Wireless networks allow mobility and flexibility, but are much less secure and interference can occur. Data transfer may also be slower.

### Why is network security important?

**Network security** is a broad term for any measures that protect a network from unauthorized access, misuse, destruction, or the sharing of confidential information. It is important because otherwise sensitive data may be shared or lost. It is also essential from a legal perspective. For businesses, corporate espionage is another a potential issue.

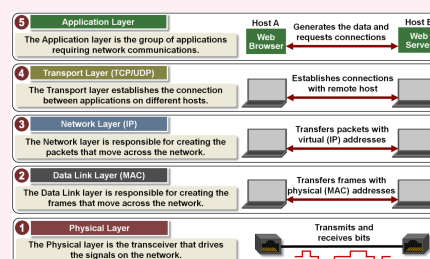
### Methods of Network Security

<b>Authentication</b>	Checking the identity of a user, usually by requiring them to input a password or biometric ID.
<b>Encryption</b>	Encoding data it using a key, meaning that the same key is needed to decrypt the data. This is how HTTPS works.
<b>Firewalls</b>	Protects a network from unauthorised access.
<b>MAC Address Filtering</b>	Allows devices to access or be blocked from accessing a network based on their physical address embedded within the device's network adapter.

### TCP/IP

<b>TCP</b>	Transmission Control Protocol, a protocol dictating how to establish and maintain a network conversation.
<b>IP</b>	Internet Protocol
<b>TCP/IP</b>	A 4-layer model that is essential to networking.
<b>Application Layer</b>	Where the network applications, such as web browsers or email programs, operate. Examples: HTTP, HTTPS
<b>Transport Layer</b>	Sets up the communication between the two hosts and they agree settings such as 'language' and size of packets.
<b>Network Layer</b>	Addresses and packages data for transmission. Routes the packets across the network.
<b>Data Link Layer</b>	This is where the network hardware such as the NIC (network interface card) is located. OS device drivers also sit here.

### TCP/IP Diagram



<http://microchipdeveloper.com/tcpip:tcp-ip-five-layer-model>

### Network Protocols

<b>Ethernet</b>	A family of protocols that dictate how devices on the same network segment format and transmit data.
<b>Wi-Fi or WLAN</b>	A family of protocols that deal with wireless transmission.
<b>TCP</b>	<b>Transmission Control Protocol:</b> splits (and later reassembles) data into packets. Also involves error checking, as expects an acknowledgement transmission within a set time frame.
<b>UDP</b>	<b>User Datagram Protocol:</b>
<b>IP</b>	<b>Internet Protocol:</b> each device has an IP address. Packets are 'addressed' to ensure they reach the correct user.
<b>HTTP</b>	<b>Hypertext Transfer Protocol:</b> used to access a web-page from a web server.
<b>HTTPS</b>	<b>Hypertext Transfer Protocol Secure:</b> uses encryption to protect data.
<b>FTP</b>	<b>File Transfer Protocol:</b> handles file uploads and downloads, transfers data and programs.
<b>SMTP</b>	<b>Simple Mail Transfer Protocol:</b> handles outbound email. SMTP servers have databases of user's email addresses.
<b>IMAP</b>	<b>Internet Message Access Protocol:</b> handles inbound emails.

A **network protocol** is a set of rules/conventions that dictate how a network operates.

### Network Topologies

What is **network topology**?

The way that a network is physically structured.

What is **star topology**?

A network where there is a central **server** that all of the computers and peripherals are connected to.

Advantages of star topology:

1. If a computer fails, there is no impact on the other devices.
2. Security is good, because the data only passes through the server, not any other devices.
3. There are no data collisions.

Disadvantages of star topology:

1. If the server fails, it's a catastrophe.
2. Lots of cabling is need to connect all the devices individually, so it's quite expensive.

### Network Topologies (cont)

What is **bus topology**?

A network where there is a central backbone of cable connecting every computer. At each end of the cable is a **terminator** to stop data from continually being moved around.

Advantages of bus topology:

1. Cheap.
2. Easy to add more devices.

Disadvantages of bus topology:

1. Only appropriate for small networks, otherwise data transmission is too slow.
2. Data collisions are likely.
3. If the backbone is severed, all computers are impacted.

### Bus Topology



<http://www.bbc.co.uk/schools/gcsebitesize/ict/datacomm/network-opsrev1.shtml>

### Star Topology



<http://www.bbc.co.uk/schools/gcsebitesize/ict/datacomm/2network-srev6.shtml>

### Types of Network

<b>PAN</b>	<b>Personal Area Network</b> - a network comprising only a small number of devices belonging to only one individual (e.g. Bluetooth).
<b>LAN</b>	<b>Local Area Network</b> - a network that encompasses a small area (e.g. one company's network).
<b>WAN</b>	<b>Wide Area Network</b> - a network comprising many devices and covering a large area (e.g. the Internet). Often under collective ownership.