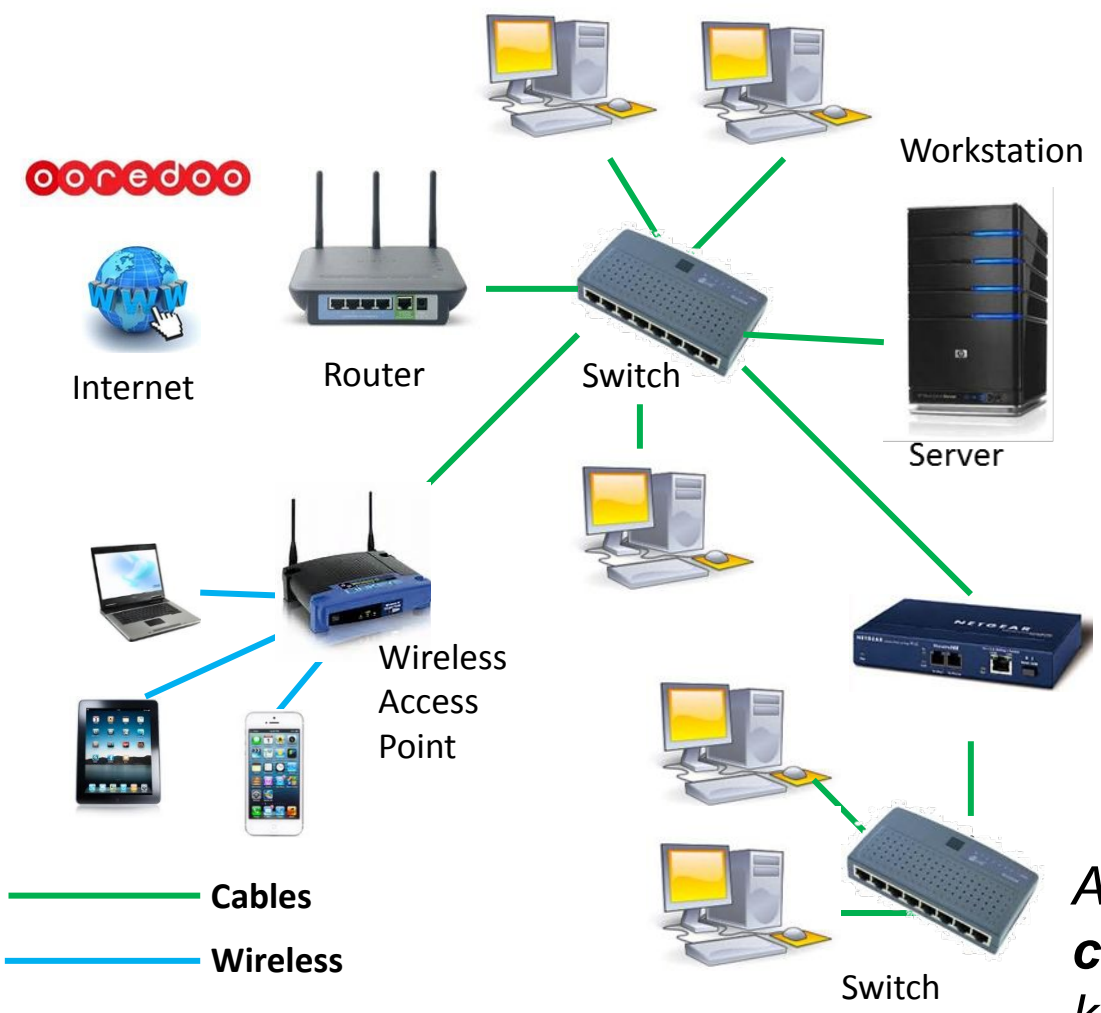
# Networks

- Understand how a router works and its purpose
- Understand the use of other common network devices, including: network interface cards, hubs, bridges, switches, modems
- Understand the use of WiFi and Bluetooth in networks
- Understand how to set up and configure a small network, including: access to the internet, the use of a browser, the use of email, access to an ISP
- Understand the characteristics and purpose of common network environments, such as intranets and the internet
- Understand the advantages and disadvantages of using different types of computer to access the internet

## Overview




## What is a Computer Network?

A network is **two or more computers**, or other electronic devices, **connected** together so that they can **exchange data**.

For example a network allows:

- **Computers to share files**
- **Users to message each other**
- **Share Resources**

Network connections between computers are typically created using **cables** (wires) or via **wireless** signals.

*A computer that is **not connected** to a network is known as a **standalone** computer.*

# Overview

## Advantages of using Networks

- Easily **share files** and **data**.
- **Share resources** such as printers and Internet connections.
- **Communicate** with other network users (e-mail, instant messaging, video-conferencing, etc.)
- **Store data centrally** (using a file server) for ease of access and back-up.
- Keep all of our **settings centrally** so we can use any workstation.


## Disadvantages of using Networks

- Greater **risk of hackers**.
- Greater **risk of viruses** (spreading and disabling network).
- The significant **cost of extra equipment**.
- When the network is down computers can not be used as **standalone** computers.
- Print **queues can be long**.

In particular, if we use a computer connected to The Internet, we can…

- Make use of **on-line services** such as **shopping** (e-commerce) or **banking**
- Get access to a huge range of **information** for research
- Access different forms of **entertainment** (games, video, etc.)
- Join **on-line communities** (e.g. MySpace, Facebook, etc.)

Using a computer connected to a network means that…

- The computer is vulnerable to **hackers**
- If the **network breaks**, many tasks become very difficult
- Your computer can more easily be attacked by a **virus**

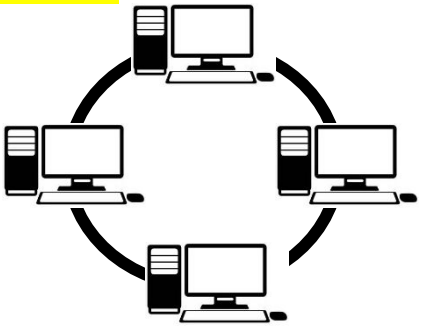
In particular, if we use a computer connected to The Internet…

- We have to be careful about **revealing personal information**
- We have to be careful to **avoid suspect websites** that might contain **malware**
- We have to be aware that **information** found on The Internet is **not always accurate or reliable**

- Networks are usually described as a type of area network. The types of network that you will have come across most frequently are **local area network** (LAN), **wide area network** (WAN) and **Wireless local area network** (WLAN).
- A **LAN** enables a group of computers that are in close proximity to each other to be networked. Typically a LAN would be used in a school, in an office or at home. A LAN is useful because it allows resources such as files, printers, games and other software applications to be shared by the computers on the LAN.
- A **WAN** normally connects LANs together to cover larger geographic areas. Typically, A WAN will connects cities, a country or many countries. The internet is an example of a WAN; it joins local area networks across most of the world.
- **WLAN** covers short distances, like a LAN. It connects wirelessly using radio or infrared signals instead of the traditional method of network cabling.

# Common network environments

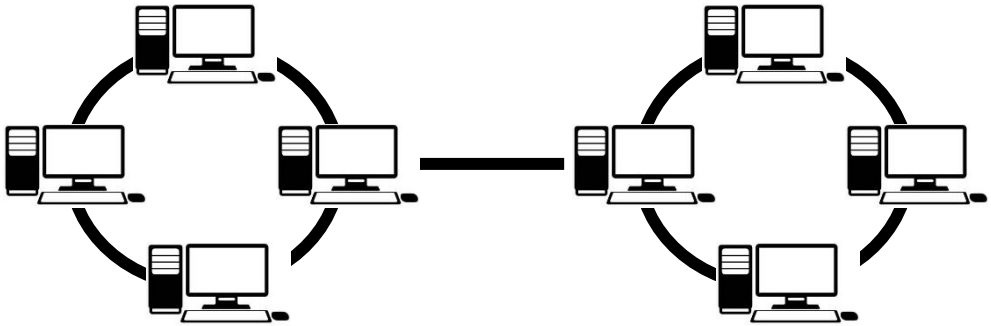
## LAN



- LAN is a Local Area Network
- LAN covers a small area (normally confined to one building or within a close proximity).
- LAN consists of number of computers and devices that usually connect to a switch which is connected to a router.

The most common examples of WAN is the internet.

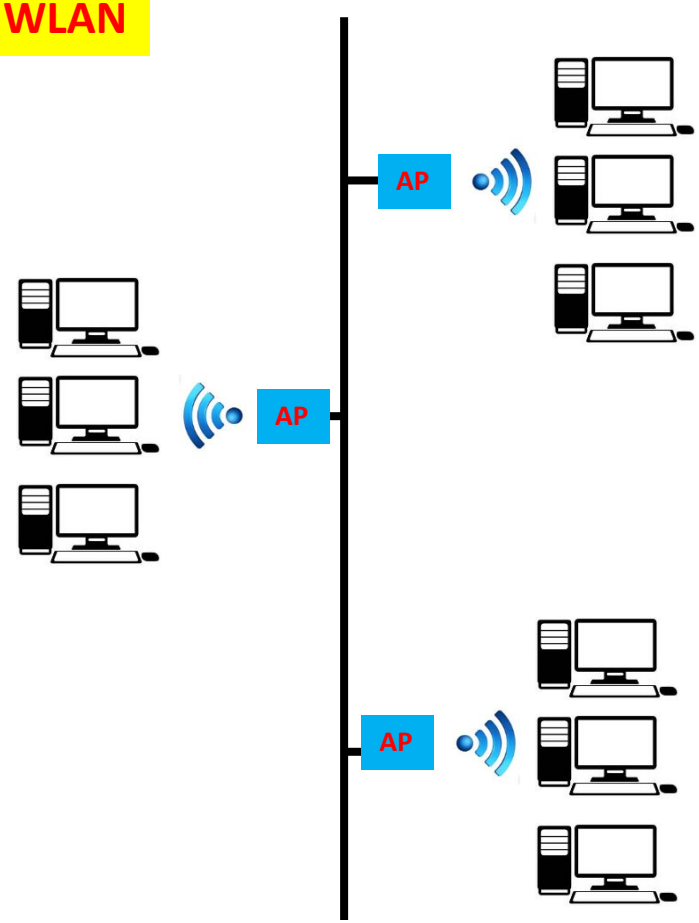
## WAN



- A WAN is Wide Area Network is a network that extends over a large geographical area.
- A WAN is often created by joining several LANs together.
- Routers are used to connect LAN networks to form a WAN Network.

## Common network environments

**WLAN**




- A wireless LAN (WLAN) is a LAN that uses radio signals (WiFi) to connect computers instead of cables.
- Devices know Access Points (AP) are connected to the wired network at fixed locations.
- These devices provide the wireless access to devices on the network.
- It is much more convenient to use wireless connections instead of running long wires all over a building.

- Router: a device that is used to forward data packets along networks, it will select the best route for each data packet so that data travels as quickly as possible to its destination
- Data packet: data sent over the internet is broken down into small parts called packets. A router will then use the best possible route to the receiver for each packet; they will be reassembled upon arrival.
- A router is often used to provide a connection between a network and the internet because of its ability to join together two dissimilar networks.

- Because a router, as its name suggests, decides on the route that a data packet should take, it needs a list of addresses; this is called a routing table, and is a data file in the router's RAM.
- The most common devices used to set up a LAN are a hub or a switch, a router, cabling, **WIFI** technology, network cards and a **modem**.

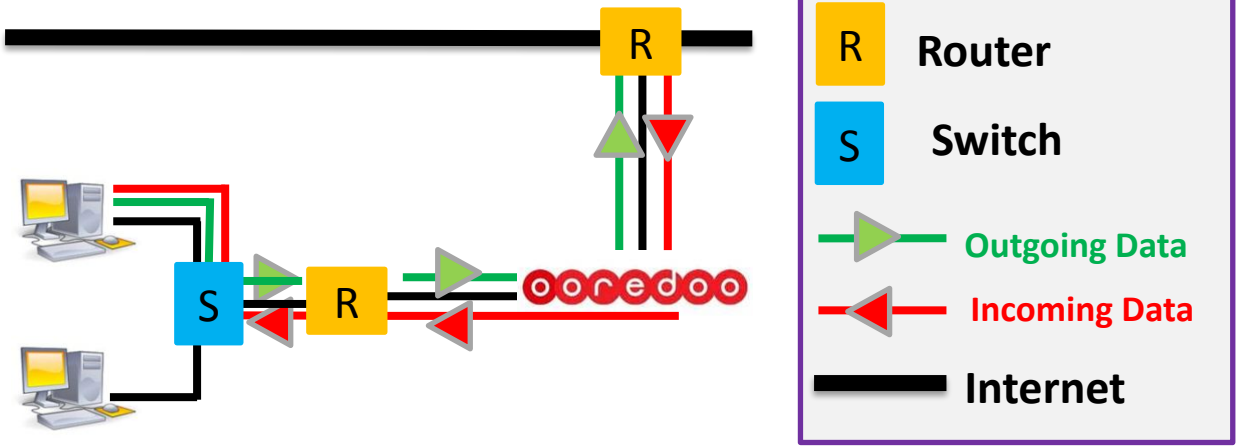
NIC - Network interface card

Modem

## Understand how a router works and its purpose

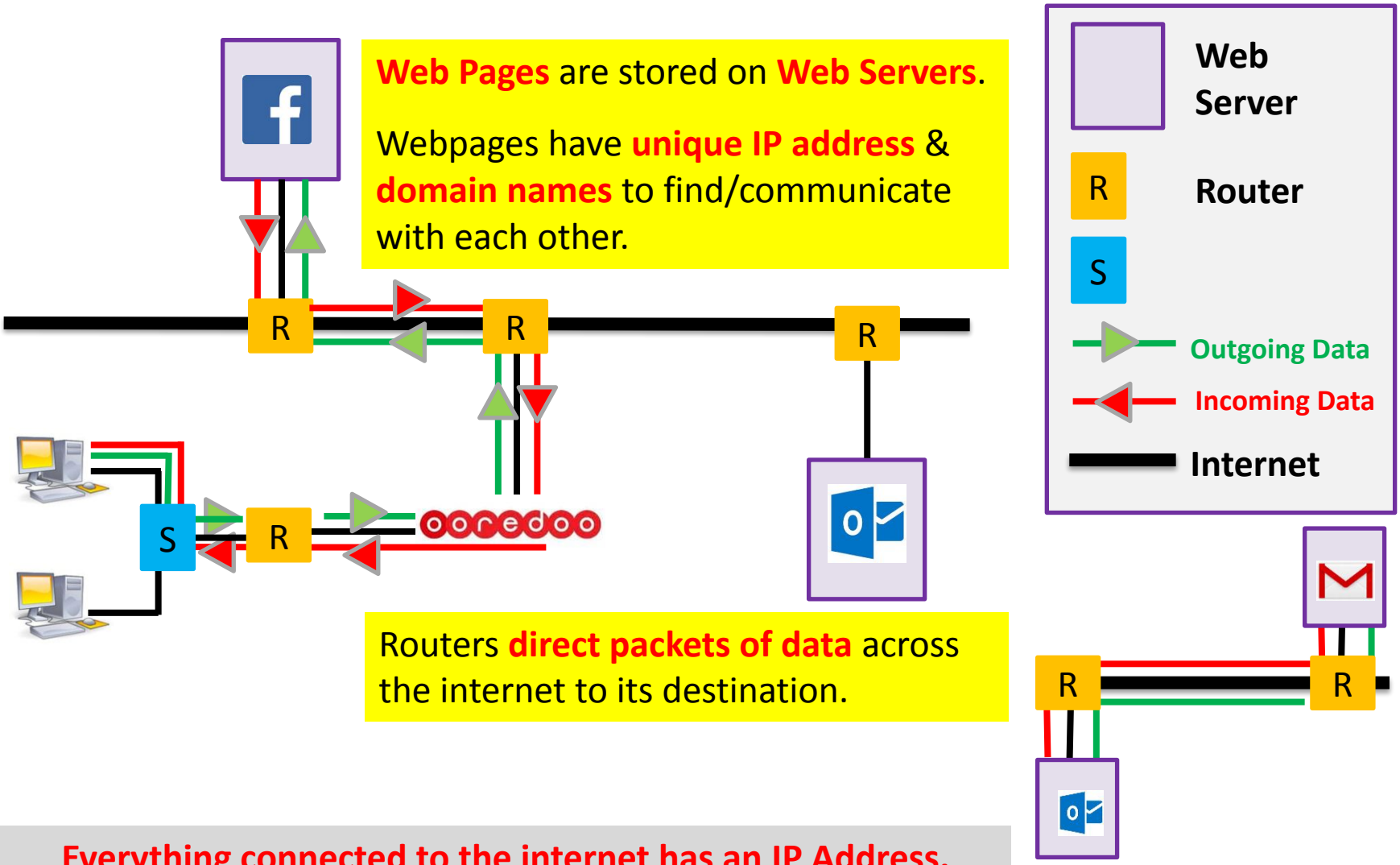
**Data Packets contain the following information:**

- Header to identify Data Packet.
- Sender and Receivers IP address.
- Number of data packets making up the whole message.




- Connects **network/computers** to the **internet**
- Connects **LANs/networks together**
- Transfers **data** between networks (**Receives and Sends Data Packets**)
- Router can connect to devices using **cables** or **wireless signals**.
- It stores information about which computer is connected to which network

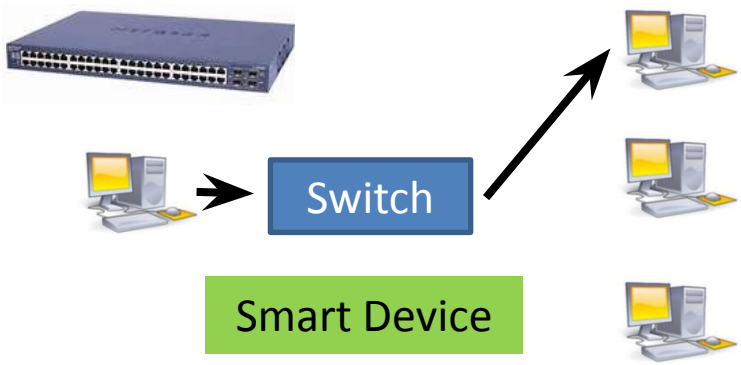
## Understand how a router works and its purpose




**Everything connected to the internet has an IP Address.**

## Common Network Devices

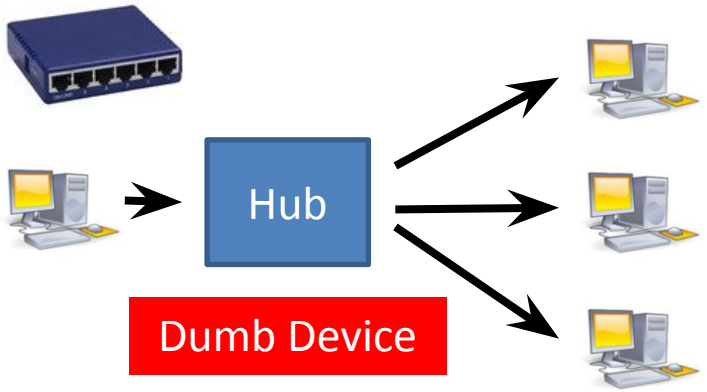
A **Hub** and a **Switch** both **connect a number of computers** together to make a **LAN**.




Sends **specific packets of data to specific computers** on the LAN using workstations unique **MAC** addresses.

**More secure however more expensive**

**Normally used in larger networks found in schools, offices etc.**

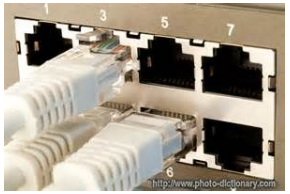



Sends **data packets** to **all** the workstations on the network which causes network traffic.

**Poor Security**

**Only would be suitable for a small home networks.**

## Common Network Devices: Switch



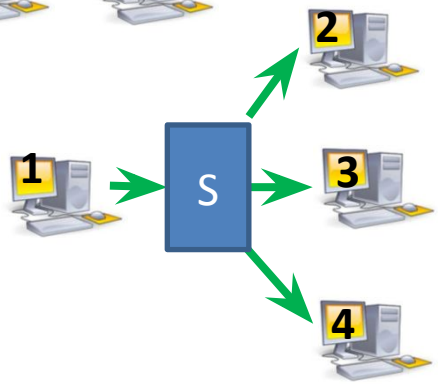
| Switch Ports | | | |
|---|---|---|---|
| 1 | 2 | 3 | 4 |

Workstation connect to switch ports. Each Network Card has a unique address (**MAC ADDRESS**) which switches can use to identify a workstation.

**You always start with an empty switch table.**

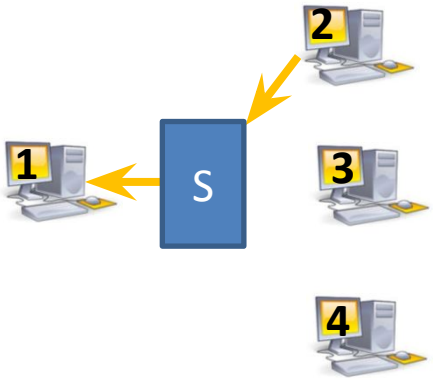
**The switch will learn each workstations MAC address when it sends a packet of data across the network.**

| Switch Table | |
|---|---|
| Work station | Mac Address |
| 1 | AA-AA-AA |
| 2 | BB-BB-BB |
| 3 | |
| 4 | |




**Sending Packets of Data from Workstation 1 – 2**

**The switch will send data packets to all computers because it does not know the MAC address for Workstation 2.**




**Sending Packets of Data from Workstation 2 – 1**

**Now the switch table has the MAC address for workstation 1 it is possible for workstation 2 to send a direct pack of data.**

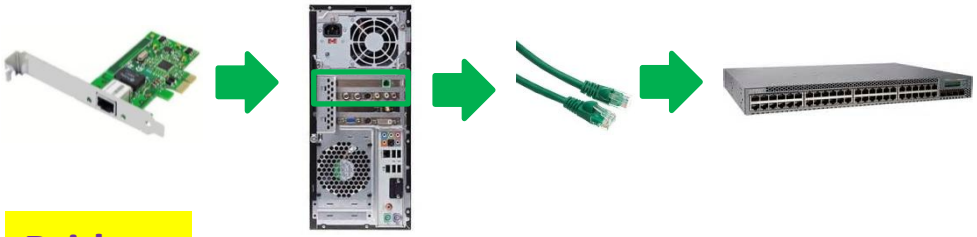
# Common Network Devices

## Modems


**Modems** convert **analogue signals from a telephone line** to **digital signals** which can be read by the computer.

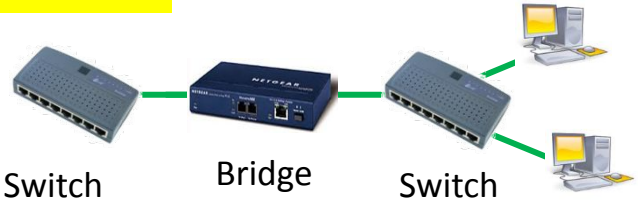
The Modem also converts **digital signals back into analogue** for **transmission over telephone lines**.

## Network Interface Card



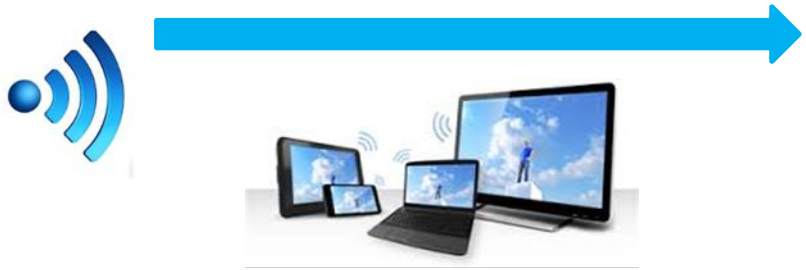
**Network Interface Card (NIC)** allows you to connect a **device to the network**. The **NIC** will contain the **MAC address** which will be used to **identify the computer** to the network.

## Bridges




A **bridge** is used to connect **two parts of a LAN network together** so they function as a **single LAN**. Two **Switches** can be connected using a the **Bridge** Device.

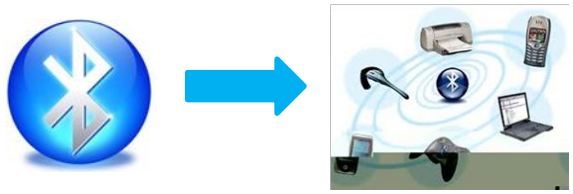
# Understand the use of WiFi and Bluetooth in networks



- Limited area of network
- Strength of signal is weaker
- Possible slow data transfer speeds
- Easier to hack into/less secure
- Physical obstacles can interfere with signal/can cause disconnection

**WiFi** is a **wireless networking technology** makes it possible to connect devices with a wireless connection to a network or to a single computer .

- Reduced cost of cabling/Safer – won't trip over wires
- Easier to connect other devices to the network
- Makes the computer portable as long as it's within range of the wireless access point



- Very slow data transfer speeds
- Short distance of coverage/limited signal strength
- Greater risk of interception of data/less secure
- Supports a limited number of devices in a network

**Bluetooth** is a **wireless networking technology** designed for very short-range connections.

- Connecting wireless devices such as mouse, phone, headset to a computer which are close in proximity.
- Transferring files between devices.
- Printing Wirelessly from a Tablet or Mobile Phone.

## Setting up a Network

**ISP (Internet Service Provider)**

Set up an account with an Internet Service Provider (ISP) to receive an internet connection to your location

**Web Browser:**

To browse the **internet**.

**Email:**

To **send email** messages including attachments to other users.

**Security:**

**Anti Virus/Spyware** software to protect your computer from **external threats** (Viruses/Hackers)

**Router:**

To connect your **LAN** to the **Internet (WAN)**

**Switch/Hub:**

To connect **Network Devices together** using cables.

**Network Cables:**

To create **physical** connections.

**Firewall:**

To keep **network secure** from external threats.

**Servers:**

To **manage network functions** such as network security, network file storage, share resources etc.

- ISP (Internet service provider): a company that provides internet services for a monthly fee; you need an ISP in order to connect to the internet.

- The internet is a global network of interconnected computer networks. The internet is used to connect people, communities and countries worldwide.
- An intranet is a private computer network within an organization, such as a school or business. Even though an intranet uses internet technologies, it is safeguarded from the global internet. It is a private area so it will require a username and password to access it.

# Intranets and the Internet

## Internet




- **Internet is Public (available to all users)**
- **Internet is network of networks**
- **Internet is global**
- **Internet has more information than an intranet**

**Typical uses of an internet would be:**

- Viewing **web pages**
- Sending and receiving **e-mail** messages
- **Sharing files**
- Communicating using **voice** (VOIP) and **video** (video-conferencing)
- Playing **multi-player games**
- Streaming Video/audio Content
- Online Shopping/Banking

## Intranet


- **Intranet is within one organisation (Private)**
- **Intranets tend to be policed/managed**
- **Intranet has an extra layer of security**
- **Data found in an intranet is likely to be more reliable/relevant than that found on the Internet**

**Typical uses of an intranet would be:**

- Viewing **internal web pages** (e.g. company schools, university's etc.)
- **Internal e-mail** and **instant-messaging** between workers
- **Sharing of internal documents**

## Accessing the Internet

| Device | Advantages | Disadvantages |
|---|---|---|
| laptop computers  | • More portable and smaller in size compared to desktop computers.<br>• Bigger screens compared to tablets and phones. | • Touchpad may be difficult to use to navigate web pages.<br>• Processors are not as fast as desktop computers. |
| Desktop  | • Stable internet connection since the connection is normally wired.<br>• Use of input devices including pointing devices to make navigation easier. | • Has to be connected to a power supply at all times.<br>• Not portable. |
| Tablets  | • Tablet: More portable than desktops/laptops however less than phones.<br>• Mobile: Portable: Easy to carry around and use whilst on the move.<br>• Mobile: Always likely to have a mobile phone at all times.<br>• Mobile: Can access internet via phone networks (4G) | • Signal strength dependant on location.<br>• Smaller display screen.<br>• Not all websites designed to be used by mobiles/tablets.<br>• Touch screen may be difficult to use.<br>• Limited battery Life. |
| Smart Phones  | | |

# Network issue and communication

Security issue - External (Hackers, viruses, malware), Internal (arise from unintentional human error - by keying in something incorrectly, to inexperience, lack of training), infringement of copyright, industrial espionage, natural occurrence, use of outdated of failing equipment, software failures and errors, not police

Password - Default password

Strong password

Two-factor authentication

Biometric method

Software - Firewall

Anti-virus software (Anti-malware software, anti-spyware software)

**Research about Data protection act**

# Communication

| Fax | Email |
| --- | --- |
| Data can be kept private | Encryption needs to be used for data to remain private |
| Faxes cannot be blocked | Messages can be blocked |
| Cannot filter faxes as junk mail | Filtering junk mail out is simple |
| Documents sent as a fax message do not contain viruses | Attachments may have viruses |

# Electronic conferencing

- A video conference allows people at different locations to see and talk to each other whilst sitting in front of a camera and microphone. This can save on time and travel costs.
- An audio conferencing is a meeting that is held between separate callers using a telephone instrument.
- Web conferencing is a live meeting that can have many different purposes such as training, collaborating or marketing or it could just be a meeting via the internet. It is interactive because you can use multimedia tools. (Presentations, file sharing…)

# Electronic conferencing

- To support electronic conferencing, the following hardware will be needed:
    - video camera
    - display screen
    - microphone
    - loudspeakers
    - high-speed network/internet connection.
- Features:
    - Switch off/ on camera
    - Raise hand
    - Mute
    - Lock meeting
    - Leave meeting
    - Team room

3 A media company with branches around the world has recently opened a new branch in London. The branch includes a number of different computer networks. Identify the most appropriate type of network to answer each of the questions.

**(a)** The type of network used to connect the branch to its head office in New York is called a

*Wide area network (WAN)* ..... [1]

**(b)** The type of cabled network used to connect computers together in one of the offices is called a

*Local area network (LAN)* ..... [1]

3 Tick the most appropriate type of network for each description.

| | LAN (✓) | WAN (✓) | WLAN (✓) |
|---|---|---|---|
| A cabled network in a building. | ✓ | | |
| A network that can use satellites. | | ✓ | |
| A network that connects countries. | | ✓ | |
| A network that uses wireless technology. | | | ✓ |

**2** Tick whether the following statements are **true** or **false**.

| | **true** (✓) | **false** (✓) |
|---|---|---|
| A router is required to allow a LAN to connect to the internet | ✓ | |
| A web browser displays a web page | ✓ | |
| An intranet has restricted access | ✓ | |
| ISP means Internal Service Provider | | ✓ |

# Chapter 4
# Exam style questions