## 4.1 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
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.
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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.
Discuss the advantages and disadvantages of using a computer network?

The advantages of using a computer network is that it is easier to share files and data. Also resources such as one printer can be shared with many workstations (computers). However printer ques could be long. Since all the computers are connected together there is a greater risk of hackers or viruses spreading which could disable the network. In addition the cost (expenditure) of the equipment could be significant. Furthermore a network will allow data to be stored centrally which will means files can be accessed from any work station on the network. Also central settings can be applied to all work stations for example restrictions in changing computer settings from the control panel.
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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.

Web Pages are stored on Web Servers. Webpages have unique IP address & domain names to find/communicate with each other.

Routers direct packets of data across the internet to its destination.

Everything connected to the internet has an IP Address.
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Common Network Devices

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

- **Switch**: 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.

- **Hub**: 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.

Smart Device  
Dumb Device

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Common Network Devices: **Switch**

<table>
<thead>
<tr>
<th>Switch Ports</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
</table>

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 workstation MAC address when it sends a packet of data across the network.

<table>
<thead>
<tr>
<th>Switch Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workstation</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

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.
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Compare and contrast the use of a Router and a Switch?

The router is used to connect Local Area Networks together to form a Wide Area Networks and also to the internet. The router will transfer data between networks using IP addresses to direct information. The switch is used to connect computers together to create a LAN. Each workstation connected to the network will have its own MAC address. The router will learn each work stations MAC address in order to send specific packets of data to the correct workstation.
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A router is connected to a LAN. Describe the function of a router?

Exam Question

Routers inspect and read the IP address of the data packets sent to it. The router will send the data packet to a switch with that IP address.

Describe the details of computer addresses that are stored by a router.

The Router stores IP addresses. IP address is a unique identifier set up by network manager/ISP. An IP address consists of 4 numbers separated by full stops. The router also stores MAC addresses. MAC address is usually hard coded by manufacturer which means it never changes.
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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 (NIC)**

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.
Chapter 4: Networks and the effects of using them

Understand the use of WiFi and Bluetooth in networks

**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
- 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

**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.
- 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 and WiFi can connect devices together. Discuss the advantages and disadvantages of using Bluetooth or WiFi.

Exam Question

Bluetooth is more useful when transferring data between two devices whereas WiFi is more suited to full scale networks. The devices connected via Bluetooth should be near to each other whereas WiFi has a larger range. Less data tends to be transferred with Bluetooth. Bluetooth uses a lower bandwidth which means data transfer speeds are slower compared to WiFi. WiFi has better security than Bluetooth however the cost of Bluetooth is cheaper than WiFi.

Bluetooth and WiFi both use wireless technology which means there is no need for cables. This reduces costs and trip hazards. Bluetooth is more energy efficient than wifi.
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Methods which can be used to connect computers to networks.

**WiFi:** Using WiFi can allow you to connect to the internet from any room in a house without the use of cables.

*In addition, multiple devices can be connected at the same time.*

**Satellite:** Satellite can be used almost anywhere in the world. Since it connects via satellites it has better coverage. Its general use is for the internet.

**3G / 4G:** 3G and 4G are used in smartphones to connect wirelessly to the Internet. Allows for access on the move even within areas with no WiFi. 3G and 4G is not affected by rain or snow as it is a form of satellite communication.
Many computer networks are connected using cables for some are now connected using wireless technology. Discuss the advantages and disadvantages of using wireless networks compared to using cabled networks.

Exam Question

The advantage of using wireless networks is that it can **increase the range of the network** making it easier to **add additional devices and computers**. With a **cabled network** you would be **restricted** to the amount of **networks ports**. Furthermore it could potentially be a **cheaper alternative** as you would not have to **buy cables** and **modify the building**. In contrast the **wireless signal could be limited** and therefore **weaker** in some parts of the network due to **physical obstacles**. The **cabled network** would provide a **more stable and quicker connection**.
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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.
Describe what an ISP is and, apart from security measures, describe what it offers its customers.

Internet Service Provider (ISP) provides Internet access. ISPs often offers web space and domain name to create own website. Also the ISP provides users with an email address. The ISP also provides a router to connect to the internet. In addition they may also offer storage space to save data in the cloud.
Chapter 4: Networks and the effects of using them

**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.

**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.

The most common examples of WAN is the internet.
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.
Describe the differences between the common network environments (LAN, WAN, WLAN)?

<table>
<thead>
<tr>
<th>LAN (Local Area Network)</th>
<th>WAN (Wide Area Network)</th>
<th>WLAN (Wireless Local Area Network)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Smaller geographical area</td>
<td>• Larger geographical area</td>
<td>• Uses wireless signals to connect devices</td>
</tr>
<tr>
<td>• Confined to one building</td>
<td>• LANs connected together form a WAN</td>
<td>• Access Points are connected to the wired networks.</td>
</tr>
</tbody>
</table>

Local Area Networks (LANs) normally cover a **smaller geographical area confined normally to one building**. Wide Area Networks are **LANs which have been connected together with a router**. They normally cover a **larger geographic area**. The connection between the LANs could either be with **cables or satellite signals**. Wireless Local Area Networks use **wireless signals** to connect devices. **Access Points** are connected to the wired networks.
# 4.1 Networks

## Intranets and the Internet

<table>
<thead>
<tr>
<th>Internet</th>
<th>Intranet</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Internet is Public <em>(available to all users)</em>&lt;br&gt; - Internet is network of networks&lt;br&gt; - Internet is global&lt;br&gt; - Internet has more information than an intranet</td>
<td>- Intranet is within one organisation <em>(Private)</em>&lt;br&gt; - Intranets tend to be policed/managed&lt;br&gt; - Intranet has an extra layer of security&lt;br&gt; - Data found in an intranet is likely to be more reliable/relevant than that found on the Internet</td>
</tr>
</tbody>
</table>

### 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

### 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
Describe the differences between the internet and intranet?

Internet is a global network of networks. It is open to the public domain whereas the intranet is private and normally within an organisation. The intranet requires authentication to log on which provides an extra layer of security. Information found on the intranet will more reliable and relevant than the internet because the intranet tends to be policed/managed. However more information is available on the internet.

Give three reasons why some companies have intranets?

It is possible to prevent employees accessing undesirable websites. The company can ensure that available information is specific to their needs. Also it will make it is easier to make sure confidential messages stay within the company. Furthermore there is less chance of company computers being hacked.
In order to make reliable information available to all students, schools often put the information on their intranet. Describe what is meant by an intranet?

An intranet is a computer network which normally exists usually within one organisation. The intranet meets the internal needs of an organization. Intranet is private and tends to be policed or managed. Intranet has an extra layer of security and data found in an intranet is likely to be more relevant to the users’ needs.
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### Accessing the Internet

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