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
4.1 Networks

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.
4.1 Networks

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.
4.1 Networks

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
Chapter 4: Networks and the effects of using them

4.1 Networks

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.
4.1 Networks

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**
4.1 Networks

Common Network Devices: **Switch**

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>Workstation</th>
<th>Mac Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AA-AA-AA</td>
</tr>
<tr>
<td>2</td>
<td>BB-BB-BB</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></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.
4.1 Networks

Common Network Devices

**Modems**

Analogue <<< Digital

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)**

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.
4.1 Networks

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.
# 4.1 Networks

## 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.

<table>
<thead>
<tr>
<th><strong>Web Browser:</strong></th>
<th><img src="image.png" alt="Chrome" /></th>
<th><strong>To browse the internet.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Email:</strong></td>
<td><img src="image.png" alt="Outlook" /></td>
<td>To send email messages including attachments to other users.</td>
</tr>
<tr>
<td><strong>Security:</strong></td>
<td><img src="image.png" alt="Kaspersky" /> <img src="image.png" alt="Norton" /></td>
<td><strong>Anti Virus/Spyware</strong> software to protect your computer from <strong>external threats</strong> (Viruses/Hackers).</td>
</tr>
<tr>
<td><strong>Router:</strong></td>
<td><img src="image.png" alt="Router" /></td>
<td>To connect your <strong>LAN</strong> to the <strong>Internet (WAN)</strong>.</td>
</tr>
<tr>
<td><strong>Switch/Hub:</strong></td>
<td><img src="image.png" alt="Switch/Hub" /></td>
<td>To connect <strong>Network Devices together</strong> using cables.</td>
</tr>
<tr>
<td><strong>Network Cables:</strong></td>
<td><img src="image.png" alt="Cables" /></td>
<td>To create <strong>physical</strong> connections.</td>
</tr>
<tr>
<td><strong>Firewall:</strong></td>
<td><img src="image.png" alt="Firewall" /></td>
<td>To keep <strong>network secure</strong> from external threats.</td>
</tr>
<tr>
<td><strong>Servers:</strong></td>
<td><img src="image.png" alt="Servers" /></td>
<td>To manage <strong>network functions</strong> such as network security, network file storage, share resources etc.</td>
</tr>
</tbody>
</table>
4.1 Networks

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.
4.1 Networks

Common network environments

- 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.
4.1 Networks

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

**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 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
### 4.1 Networks

#### Accessing the Internet

<table>
<thead>
<tr>
<th>Device</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>laptop computers</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: Can access internet via phone networks (4G)</td>
<td>• Not all websites designed to be used by mobiles/tablets.</td>
</tr>
<tr>
<td>Smart Phones</td>
<td>• Mobile: Always likely to have a mobile phone at all times.</td>
<td>• Touch screen may be difficult to use.</td>
</tr>
<tr>
<td></td>
<td>• Mobile: Can access internet via phone networks (4G)</td>
<td>• Limited battery Life.</td>
</tr>
</tbody>
</table>