

Computer Networks

# Assignment 2

Unit 9

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## Key Components

When building a network, there are many key components that are required to build it. Here I will go over what they are with a brief explanation of what they do.

### End Devices

- Desktop – your general-purpose computer that can be used to access the internet, usually confined to a single space in the network as they are not portable devices. These devices are best connected via ethernet.
- Laptops – general-purpose computers that are very portable and are best connected via Wi-Fi.

Both a desktop and laptop will have a Network Interface Card (NIC) inside of them, which will allow them to connect to the internet via Wi-Fi or ethernet.

- Server – used to provide services to devices around the network, such as a logon server for file sharing.

At least 2 devices are required to make a network.

### Connection Media

- Wi-Fi – the technology used to connect millions of devices to the internet via the transmissions of radio waves back and forth between a router. The said router then uses a wired connection to connect to the internet. Wi-Fi usually operates on 2 frequencies: 2.4GHz or 5GHz.
- Ethernet – the technology used to transmit data through cables such as twisted copper pairs or fibre optic. Ethernet is mainly used for networking, connecting end devices such as computer directly to the router (or through a switch). Ethernet is much faster than Wi-Fi as it is often a direct connection to the router.

### Interconnection Devices

- Router – used to connect networks together and then connects them to the internet, these devices usually have switch-like functionality to build into them too, however they have limited ports.
- Switch – used to connect devices on a network together. When a device connects to a switch, it reads the MAC address from the device and saves it with its port number. Then when traffic from a network enters the switch, it knows which port to send the data too.
- Hub – used to connect devices on a network together. Unlike a switch, hubs just broadcast any data they receive to all devices connected, even if they aren't the intended recipient of the data.
- Wireless Access Point – used as an access point for devices to connect to Wi-Fi. This is done via transmitting data over radio waves. Usually on the 2.4GHz and 5GHz band.

### Software Needed

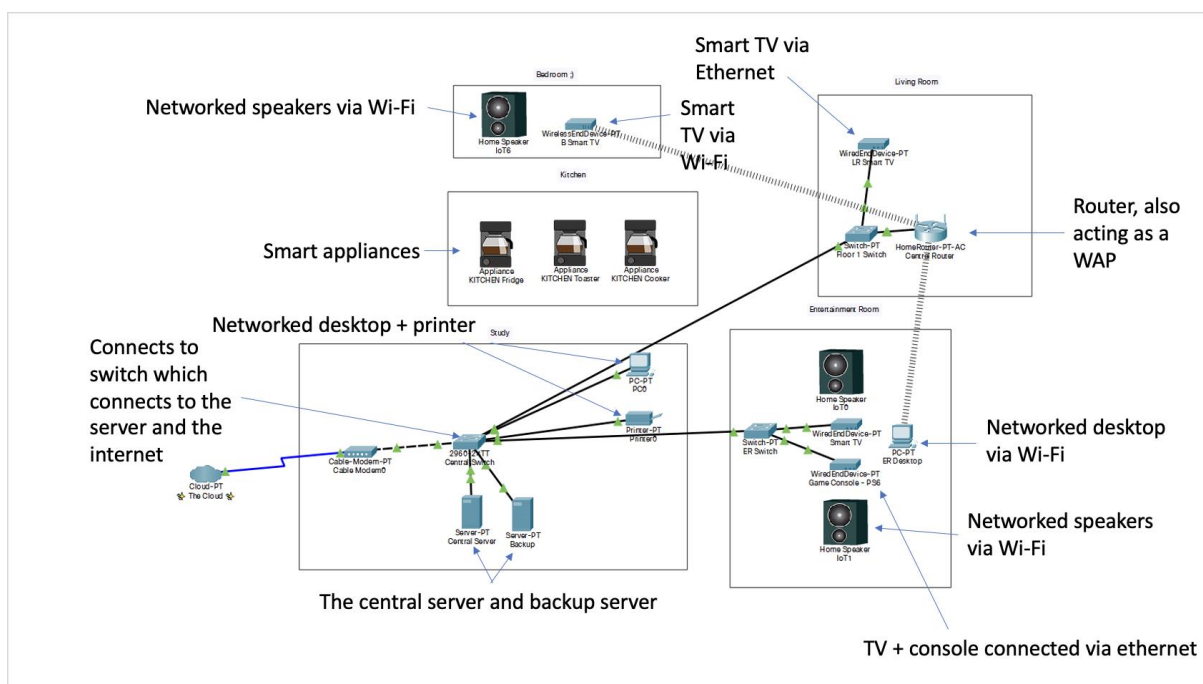
- An Operating System – they would be installed on the end devices and would allow the device to connect to the internet as it would be able to utilize the NIC and communicate with the rest of the network.

Some operating systems come with more functionality than others – for example for a server you would install an OS such as Windows Server, which would have built-in functionality for services such as file sharing or logon. Then as general desktops do not need this functionality, they can just install a regular copy of Windows.

- Security Software – this is software such as a firewall to filter any unwanted traffic coming into or leaving the network. This can usually be found on both routers and end devices. The router's firewall will dictate what can leave or enter the network, whilst the end device's firewall dictates what can leave or enter its own system.

## Network Diagram and Explanation

Here is the network I designed and annotated.



Why does each room connect?

The Study

In the Study, I have chosen to put the modem for the access out to the internet, so the central servers have the quickest access to it to ensure the best response times when accessing the server. The modem connects to the central switch, where all connections from the rest of the network come in. The router for the internet connection is then cabled from the central switch to the living room so it can provide the best Wi-Fi access.

The Entertainment Room

In the entertainment room, I have put another switch inside to connect the TV and the gaming console to ensure they get the best multiplayer performance possible. The switch then connects back to the main central switch. The two speakers and the computer are connected to Wi-Fi, this is to allow for less cabling and more portability around the room.

### The Kitchen

Inside the kitchen, there are the IoT devices which connect via Wi-Fi to reduce the cabling needed and to reduce any risks with the cables, for example spilling water or accidentally damaging them.

### The Living Room

Inside the Living Room, I have placed another switch when then connects to the router which provides Wi-Fi to the whole house. I have placed it here as it is in the centre of the house to ensure all devices using Wi-Fi get a connection. The TV also connects to the switch. The switch then connects back to the central switch which provides internet access and the connection to the server.

### The Bedroom

Finally in the Bedroom, I connected the TV to Wi-Fi to reduce the number of cables needed, especially as the room may be compact, and it allows for the device to be moved around in the future. The IoT speakers then also connect to Wi-Fi so they can be moved around in the future if needed.

## The Function of Interconnection Devices

### Modems

A modem is used to connect a network to the internet. This is done via modulating and demodulating electric signals so they can be transmitted over wires. This is converting a digital signal into an analogy signal for transmission over phone lines, coaxial cables, etc.

### Repeater

A repeater is used to boost the strength of a transmission. It receives a signal and then retransmit the signal to allow it to travel over a longer distance.

### Bridge

A bridge is used to connect two networks together, like an older switch. When it receives data it broadcasts it to all nodes, but overtime will learn which MAC address is in which port and send it specifically to them.

### Router

A router is used to connect networks together and then connects them to the internet, these devices usually have switch-like and functionality to build into them too, however they have limited ports. Routers also tend to have WAPs built into them.

### Gateway

A gateway is a node in a network that is considered a “key stopping point” for data. An example of a gateway is your ISP that gives access to the rest of the internet, or in a wireless network the gateway would be your modem (or router combo).

### Switch

A switch is used to connect devices on a network together. When a device connects to a switch, it reads the MAC address from the device and saves it with its port number. Then when traffic from a network enters the switch, it knows which port to send the data too.

## Hub

A hub is used to connect devices on a network together. Unlike a switch, hubs just broadcast any data they receive to all devices connected, even if they aren't the intended recipient of the data.

## Wireless Access Point

A WAP is used as an access point for devices to connect to Wi-Fi. This is done via transmitting data over radio waves on the 802.11 standard. Usually on the 2.4GHz and 5GHz band.

## Network Interface Card

A NIC is a component of a computer that transmits and receives data on a network, allowing you to connect to the internet. This is usually done via an ethernet port.

## Media Extenders

A media extender is a device that receives video and audio data and makes it accessible to devices found in home theatre systems, such as TVs or speakers.

## Connectors and Cabling

There are two ways networks can connect: wired and wireless.

### Wired Networks

Wired networks are connected via ethernet cables into RJ45 ports on Network Interface Card. These then often connect back to a switch, which will have a connection to a router where the network can access the internet.

### Wireless Networks

Wireless Networks connect to a Wireless Access Point which uses the 802.11 standard of Wi-Fi. Data is transmitted over radio waves on the 2.4GHz and 5GHz. The WAP can then either connect back to a switch, or directly to a router which can then provide internet access.