

CO1507 Introduction to Networking

Network Devices and Network

Topology

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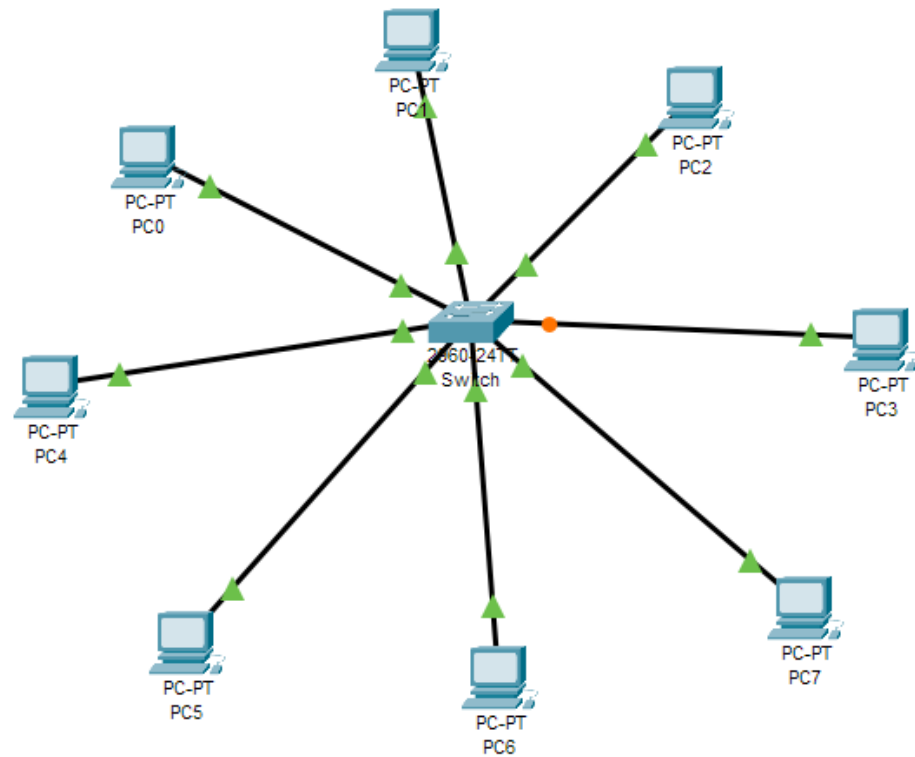
What is a Network?

- A network in its minimal form is **2 or more** devices that are connected together
- Computers on a network can **communicate** with one another, sharing **files** and other **resources**
- There are many different types of network, however this simple definition remains constant
- Networks can take on many forms..
 - Span from the tiniest to largest areas
 - Include any number of machines
 - Be connected with or without the need for wires

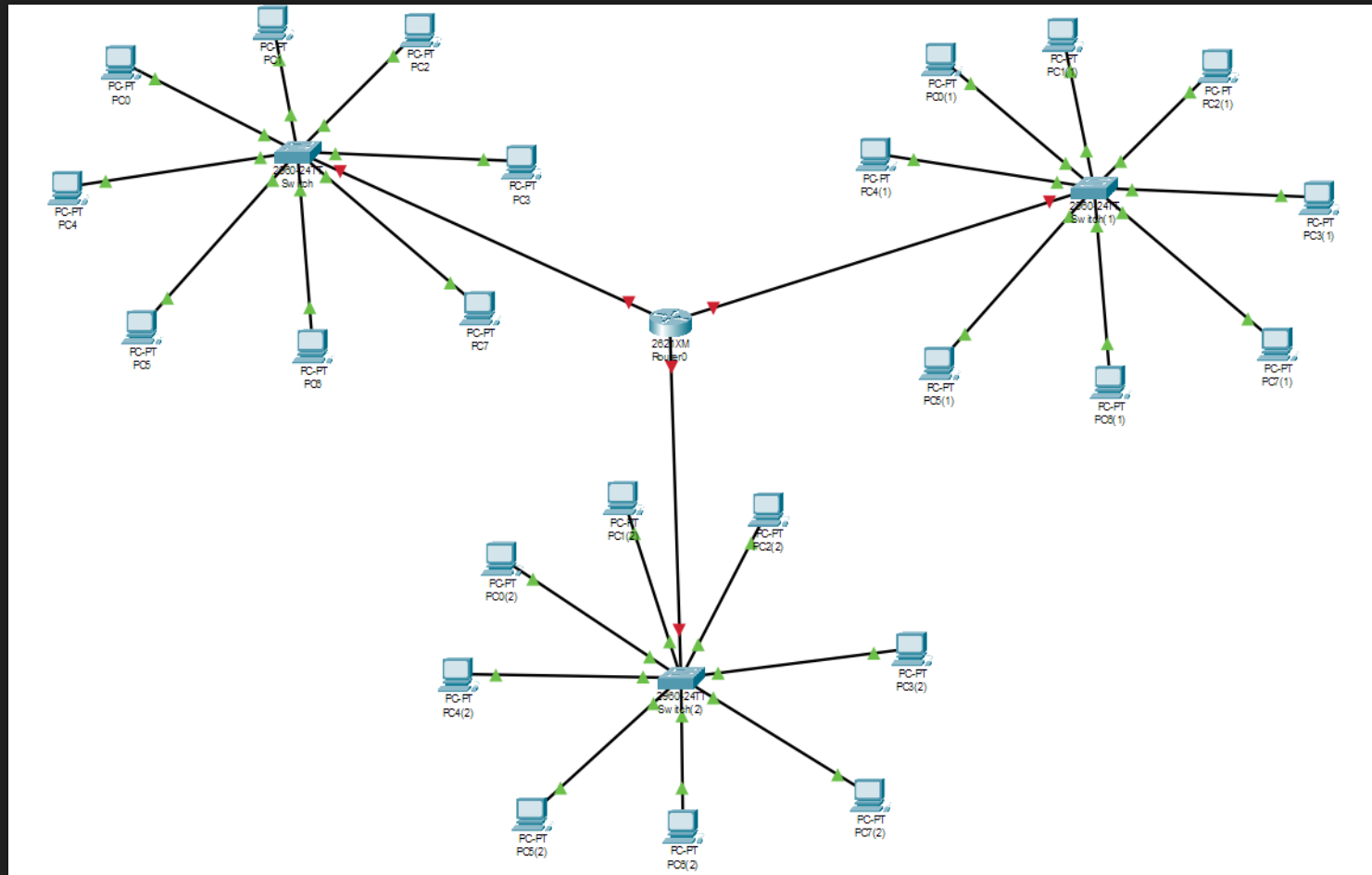
LANs and WANs

- **LAN** and **WAN** are two common acronyms which define the two most common types of network
- **LAN** or **L**ocal **A**rea **N**etwork is typically a small network, including fewer machines, spread over a smaller geographical area
- **WAN** or **W**ide **A**rea **N**etwork is typically a larger network, including more machines, spread over a larger geographical area
- However, one key difference is that a **Wide** Area Network requires **ROUTING** (and therefore a **ROUTER**) whereas a **Local** Area Network does **not**

Local Area Network Example Topology

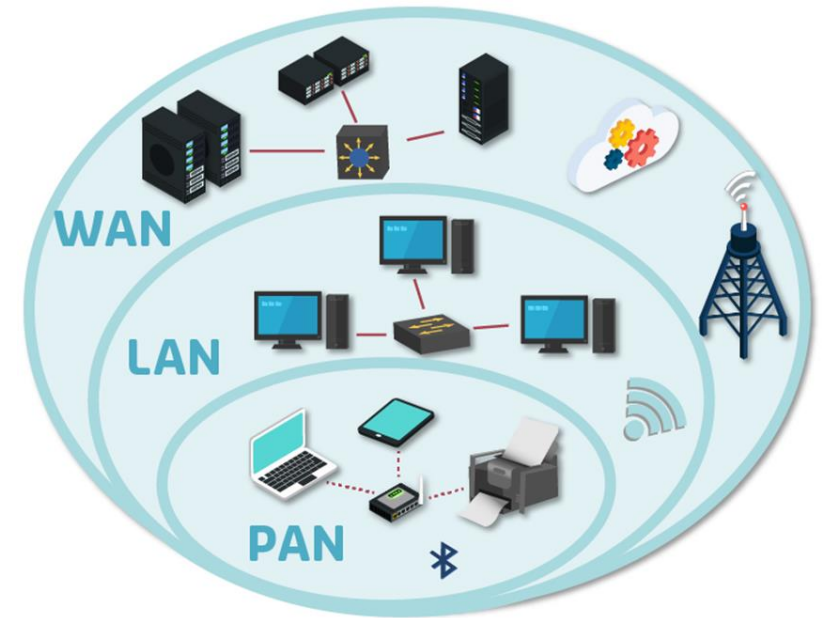


Wide Area Network Example Topology



Other Types

- There are also other network definitions including:
 - **PAN** - Personal Area Network
 - **MAN** - Metropolitan Area Network
 - **WLAN** - Wireless Local Area Network
 - **VLAN** - Virtual Local Area Network
 - and more besides..
- However, these definitions are less important as they could all arguably be classed as either a type of **LAN** or a type of **WAN**



The Internet

- *“The Internet is a worldwide collection of interconnected networks, cooperating with each other to exchange information using common standards. Through telephone wires, fibre optic cables, wireless transmissions and satellite links”*

Cisco (n.d.)

Devices - The Host

- A network **host** is a computer or related device that is connected to a computer network.

“A network host may offer information resources, services, and applications to users or other nodes on the network”

(Microsoft, n.d.).

- Examples of hosts include; PCs, Laptops, Printers, Tablets, Games Consoles, IP Phones, IP webcams, Routers, IOT devices.. Etc.



Devices – The Switch

- A **switch** is a device which connects network devices together on a **LOCAL AREA NETWORK**
- Hereafter, devices on a network will be referred to as '**hosts**'
- There are exceptions to this definition of a switch, but these go beyond the scope of this module
- A **switch** connects devices on a network by using **packet-switching** in order to receive and forward data to the destination device
- In the past a less sophisticated device called a **Hub** was commonly used, these are rare nowadays as performance on a hub was poor with bandwidth divided by the number of hosts



Devices - The Router



- A **Router** is a device which connects together different **Local Area Networks** allowing hosts from one to communicate with hosts on another, thus creating a **Wide Area Network**
- A router's role is to **route** packets between LANs
- The **Internet** consists of millions of routers
- The router must use **IP addressing** to decide where traffic should be sent
- The router must maintain **routing tables** in order to facilitate routing of traffic to the correct destination

Home 'Routers'

- You may call the device in your house provided by your internet supplier a *router*, or simply a *home hub*
- It is actually several things all in one box:
 - Some form of **modem** (Cable, DSL, Fibre-Optic)
 - A **Switch**
 - A **Router**
 - A Wireless **access-point**



Devices – Network Adapters (NICs)



- In order for end devices to communicate with the network they must contain a **Network Interface Card (NIC)**
- Every **NIC** has a unique **hardware address** (aka **MAC address**) stored on a chip that sits on the card.
- The MAC address allows the device to be identified when connected to the network
- In reality a 'card' may be a tiny chip integrated on a circuit board, however it is still an network adaptor

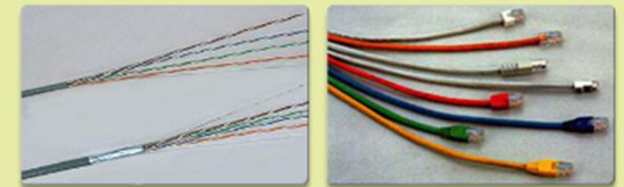
Transport Media

- Networks can be connected by **wires**, **wirelessly** or by a **combination** of the two
- Wireless Local Area Networks typically use the **Wi-Fi** standards

*Though technologies such as **Bluetooth** are also a type of network

- **Wired** networks typically use **copper** cables, most commonly **Category 5 UTP** (**U**nshielded **T**wisted **P**air)
- **Fibre-optic** cabling can also be used in networks
- **Fibre-optics** are resistant to **electromagnetic** interference, and the signals can travel across much greater distances

Copper



Fiber Optic

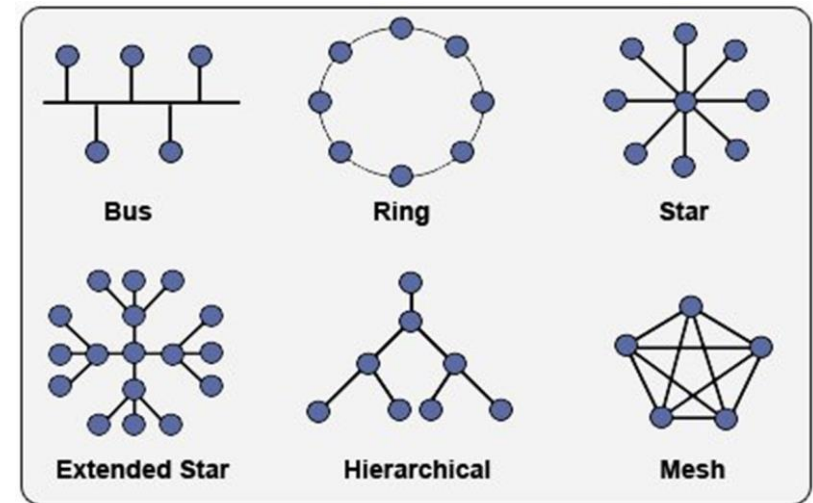


Wireless



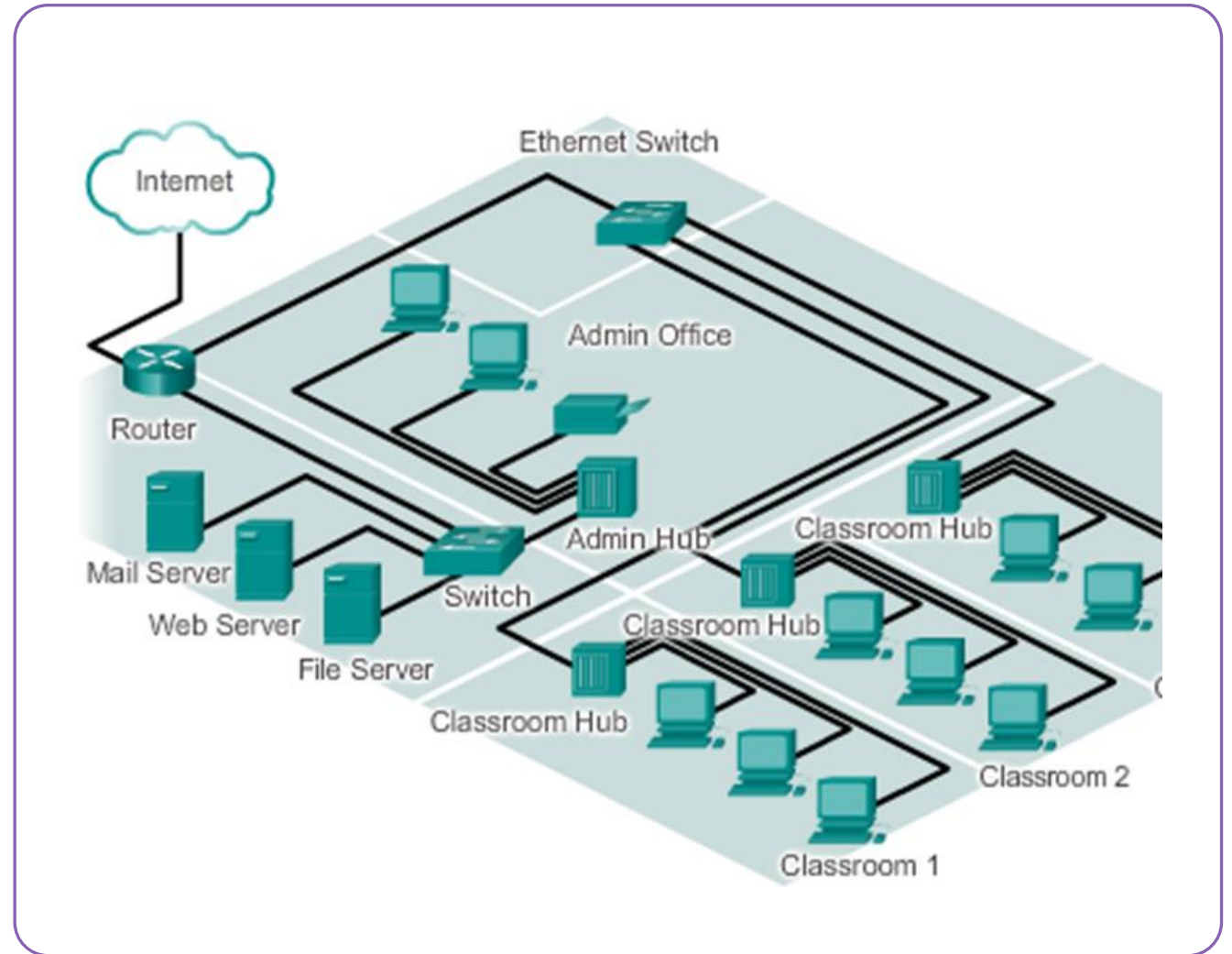
Topology

- In networking, the term "**topology**" refers to how network equipment is arranged in order to communicate.
- How this is done could be limited by the communication protocols the equipment uses, cost, geography or other factors such as the need for redundancy.
- Topology diagrams provide a visual map of the network.
- There are two types of topology diagrams including:-
 - **Physical**
 - **Logical**



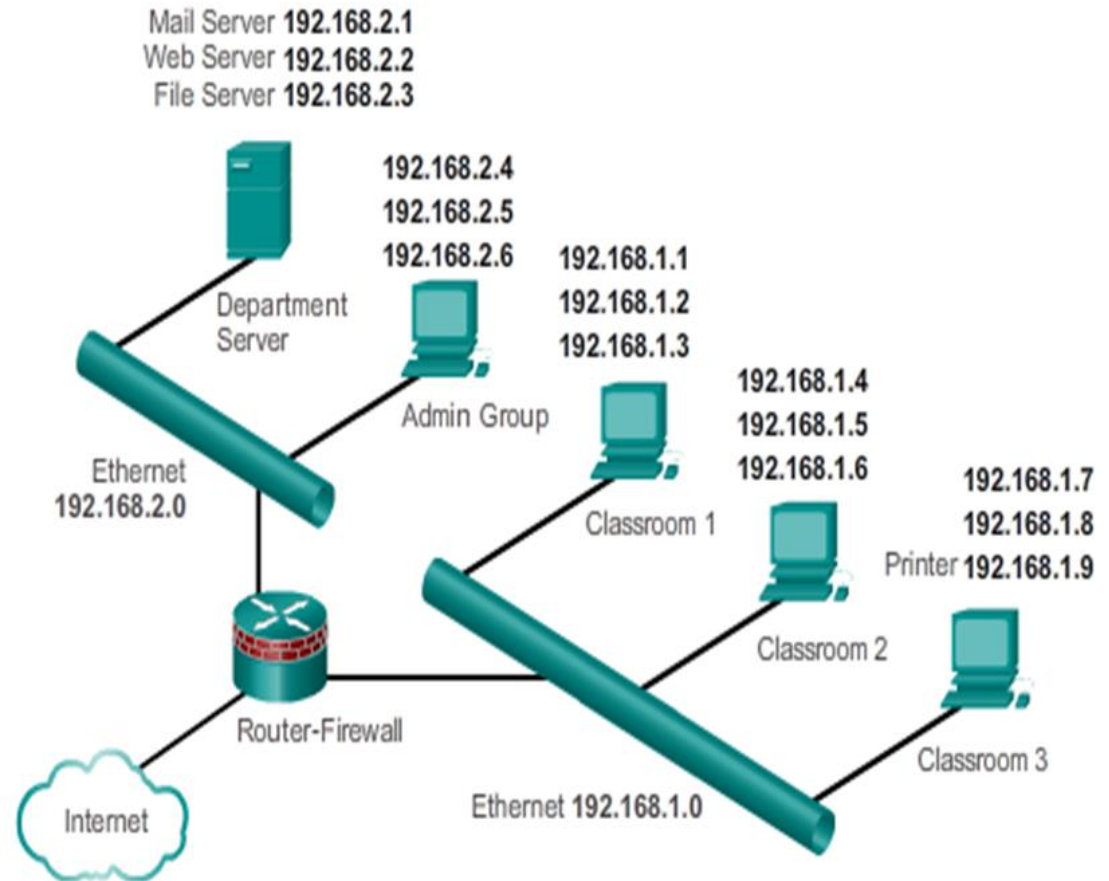
Physical Topology

- A **Physical** topology identifies the physical location of intermediary devices, configured ports and cable installation.

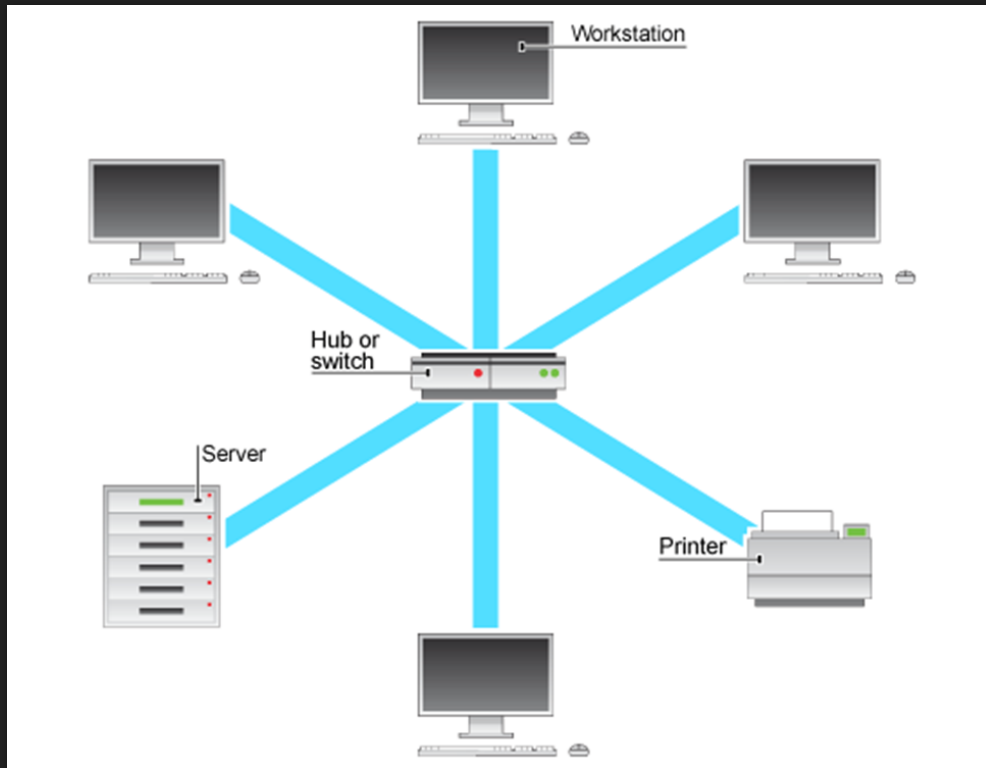


Logical Topology

- A **Logical** topology identifies devices, ports and IP addressing scheme.



Star Topology (Ethernet)



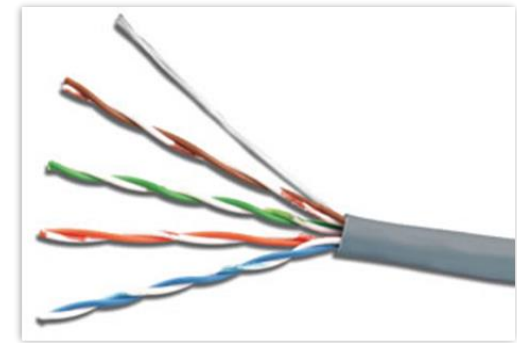
- The **star** topology (or extended star) is very common found in offices, educational establishments etc. all around the world
- Hosts on **Local Area Networks** are connected by copper cables to **switches**
- In an extended **star** (Wide Area Network) **routers** will feature as well

Twisted pair cabling

- **Twisted pair** is the most common kind of copper telecommunication wiring.
- To reduce **crosstalk** or **electromagnetic induction** between pairs of wires, two insulated copper wires are **twisted** around each other.



RJ45 Connector



Unshielded Twisted Pair (UTP) cable

Collision Domain

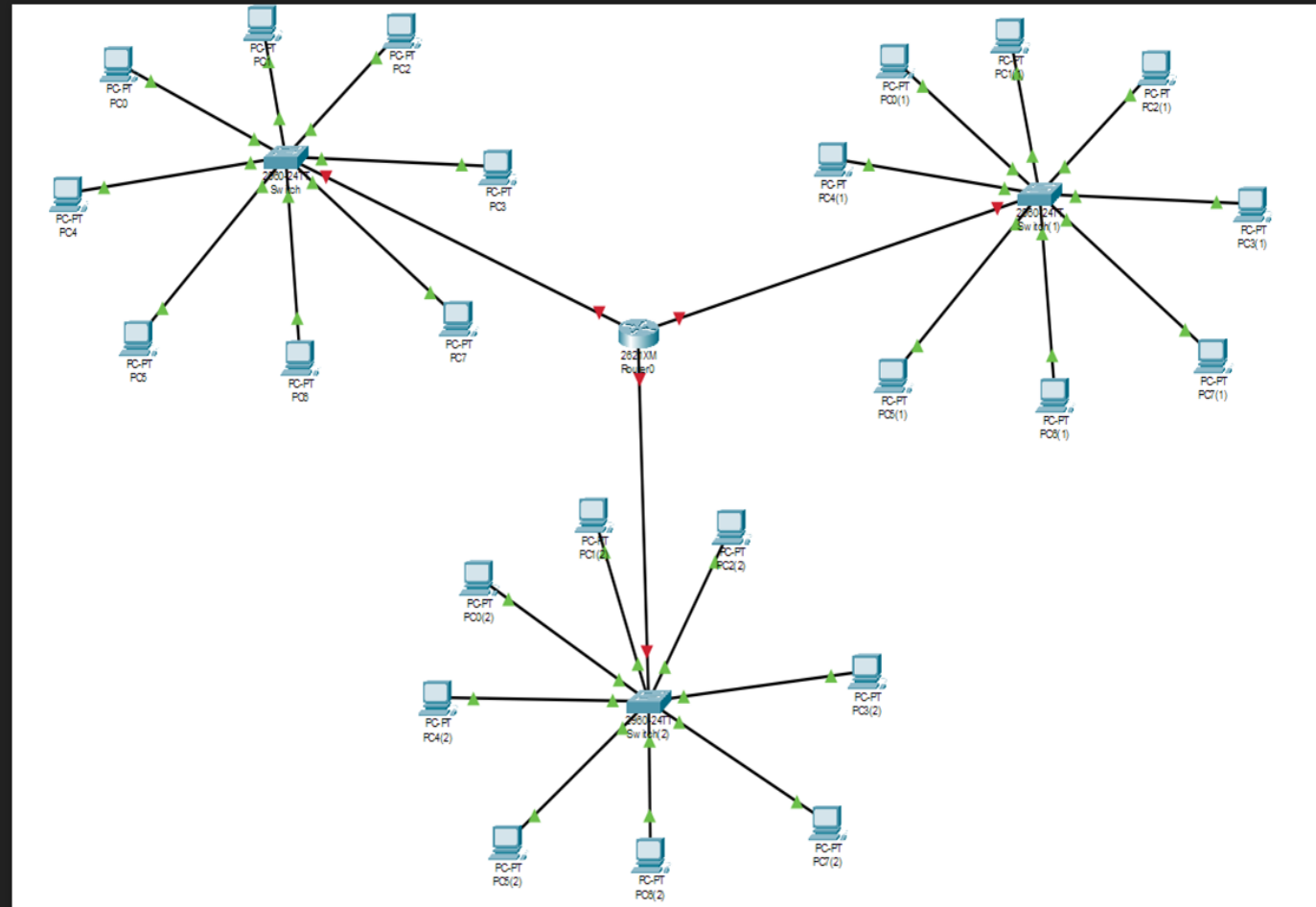
- A **collision domain** is the area of the network within which traffic can **collide** at the same time when multiple hosts attempt to communicate at the same time
- A **switch** has separate collision domains for every host - this is very efficient
- Whereas with an old fashioned **hub** (or even older still **ring network**) the whole **LAN** would be one large **collision domain**
- A **switch** breaks up **collision domains**
- However doesn't mean there will never be a collision, because sometimes messages need to be sent to **EVERY** host of the network at the same time.
- When this happens it is called a **Broadcast**

Broadcast Domain

- A **broadcast domain** is the area of the network within which broadcasts can be received
- A **broadcast** domain is essentially the entire Local Area Network
- It is very important for this to happen for certain operations
- However, broadcasts do not stray beyond **routers**, and so are confined to a Local Area Network
- A **router** splits **broadcast domains**

Broadcast Domain

- There are **3 broadcast domains** in this diagram.
- However there are MANY more much smaller **collision domains**
- (Point to point between each host)





Any Questions?