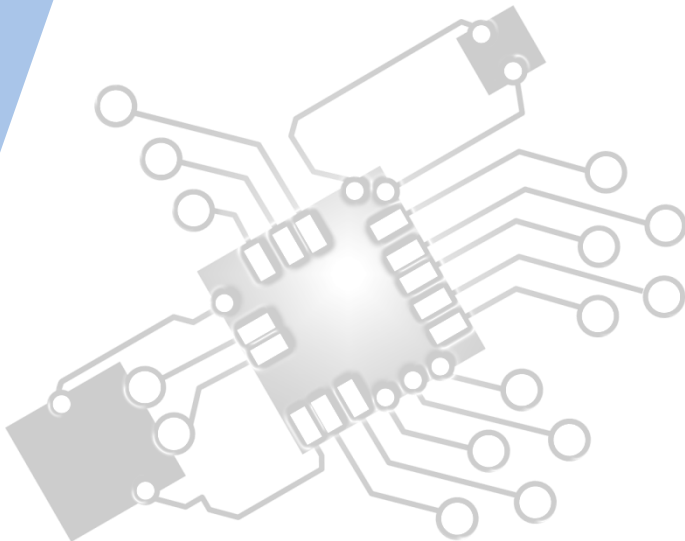




Network *fundamentals*

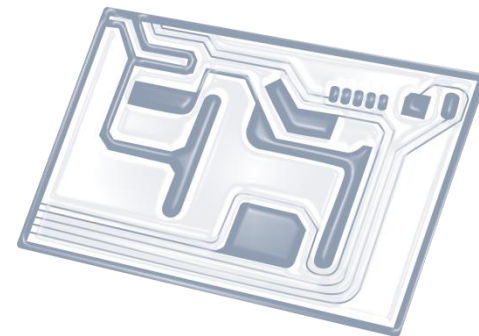
IB Computer Science



*Content developed by
Dartford Grammar School
Computer Science Department*



HL Topics 1-7, D1-4



1: System design



2: Computer Organisation



3: Networks



4: Computational thinking



5: Abstract data structures



6: Resource management



7: Control



D: OOP

HL & SL 3 Overview

Network fundamentals

- 3.1.1 Identify different types of networks
- 3.1.2 Outline the importance of standards in the construction of networks
- 3.1.3 Describe how communication over networks is broken down into different layers
- 3.1.4 Identify the technologies required to provide a VPN
- 3.1.5 Evaluate the use of a VPN

Data transmission

- 3.1.6 Define the terms: protocol, data packet
- 3.1.7 Explain why protocols are necessary
- 3.1.8 Explain why the speed of data transmission across a network can vary
- 3.1.9 Explain why compression of data is often necessary when transmitting across a network
- 3.1.10 Outline the characteristics of different transmission media
- 3.1.11 Explain how data is transmitted by packet switching

Wireless networking

- 3.1.12 Outline the advantages and disadvantages of wireless networks
- 3.1.13 Describe the hardware and software components of a wireless network
- 3.1.14 Describe the characteristics of wireless networks
- 3.1.15 Describe the different methods of network security
- 3.1.16 Evaluate the advantages and disadvantages of each method of network security



1: System design

2: Computer Organisation



3: Networks

4: Computational thinking



5: Abstract data structures

6: Resource management



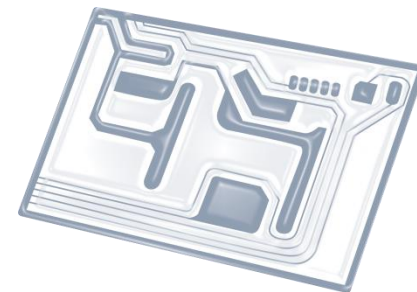
7: Control

D: OOP



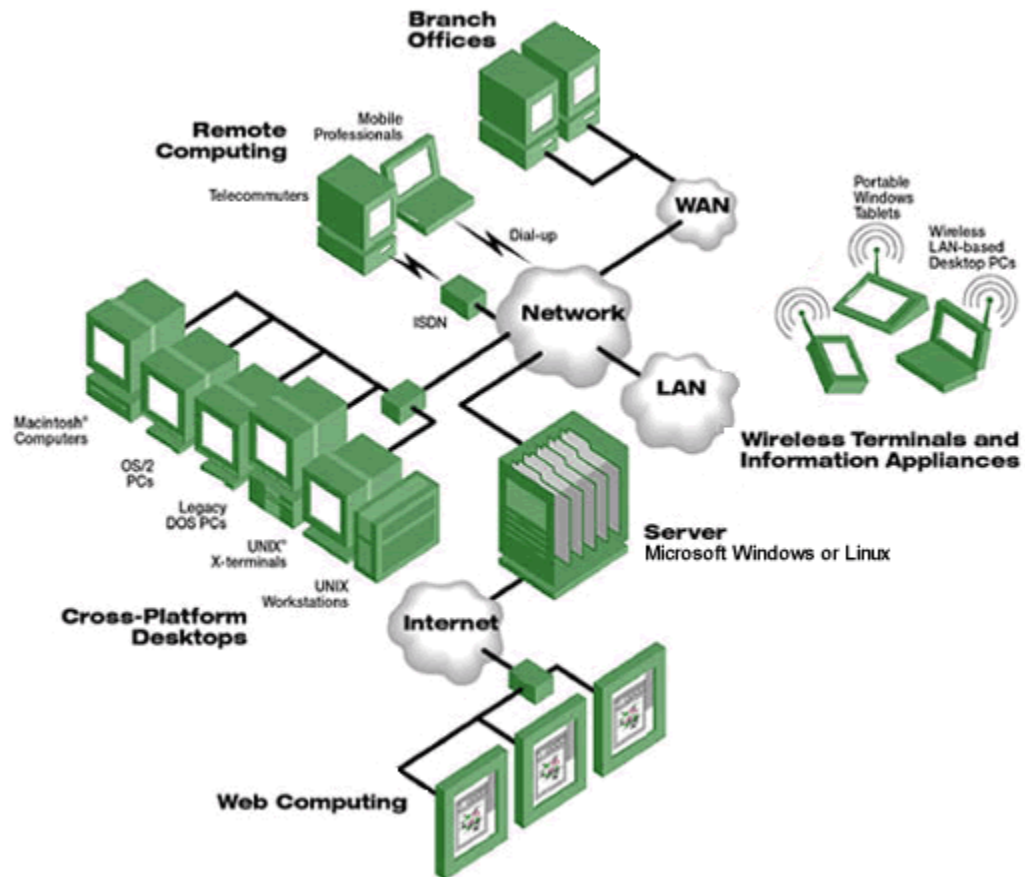
Topic 3.1.1

Identify different **types** of **networks**



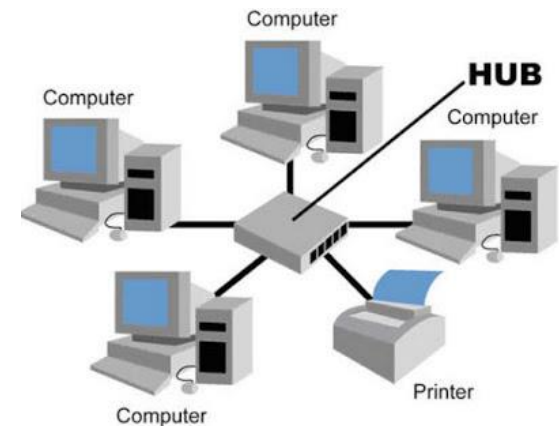
Types of Networks

- LAN
- WAN
- VLAN
- SAN
- WLAN
- Internet
- Extranet
- VPN
- PAN
- P2P

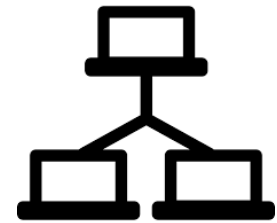


Definition: Network

- A computer network is a **group** of **computer systems** and other computing **hardware devices** that are **linked** together through **communication channels** to facilitate **communication** and **resource-sharing** among a range of users.
- Networks are commonly categorized based on their characteristics.



LAN = Local Area Network



- LAN stands for **local area network**. It covers, as the name suggests, a local area.
- This usually includes a local office/building and they're also pretty common in homes now, thanks to the spread of Wi-Fi.
- Whether wired or wireless, nearly all modern LANs are based on **Ethernet**, a set of protocols for exchanging data.
- There are two ways to implement Ethernet: **twisted-pair cables (UTP)** or **wireless (Wi-Fi radio waves)**.



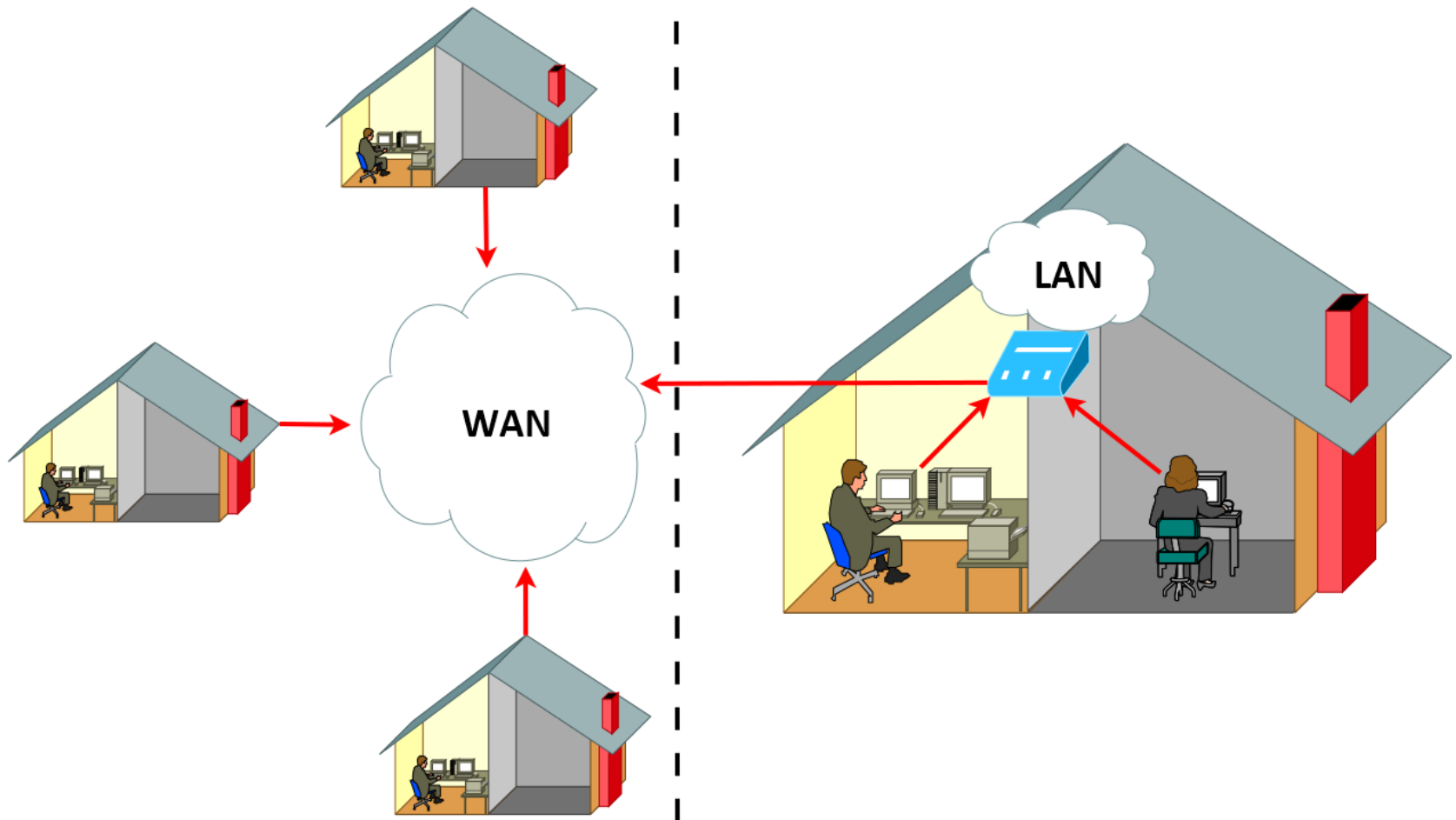
LAN



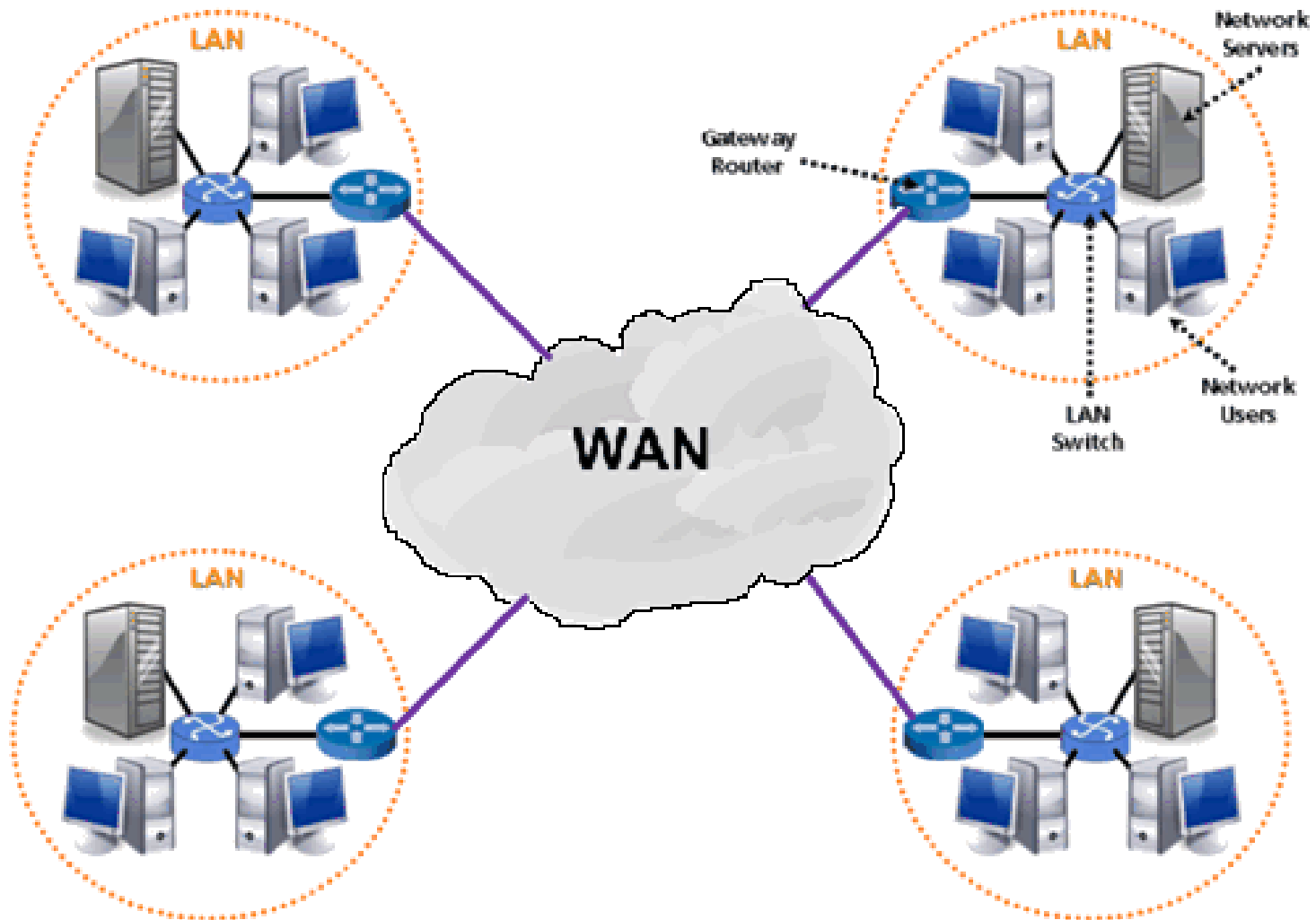
WAN = Wide Area Network

- The name is exactly what it sounds like: a network that covers an **area wider than a LAN**.
- Beyond that, the definition is less clear. Distances can range from a network connecting multiple buildings on a corporate or college campus to satellite links connecting offices in different countries.
- The most popular WAN is the **internet**.
- It's actually a collection of other networks, including other LANs and WANs – hence, the name.
- WANs can be **wired** (using **fibre-optic cable**) or **wireless** (using **microwave** or **satellite transmission technology**).

LAN vs WAN



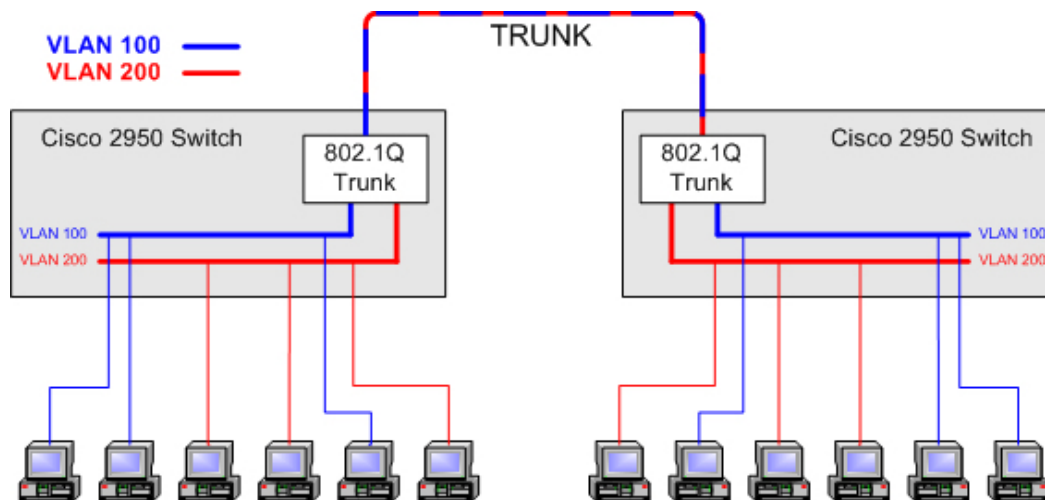
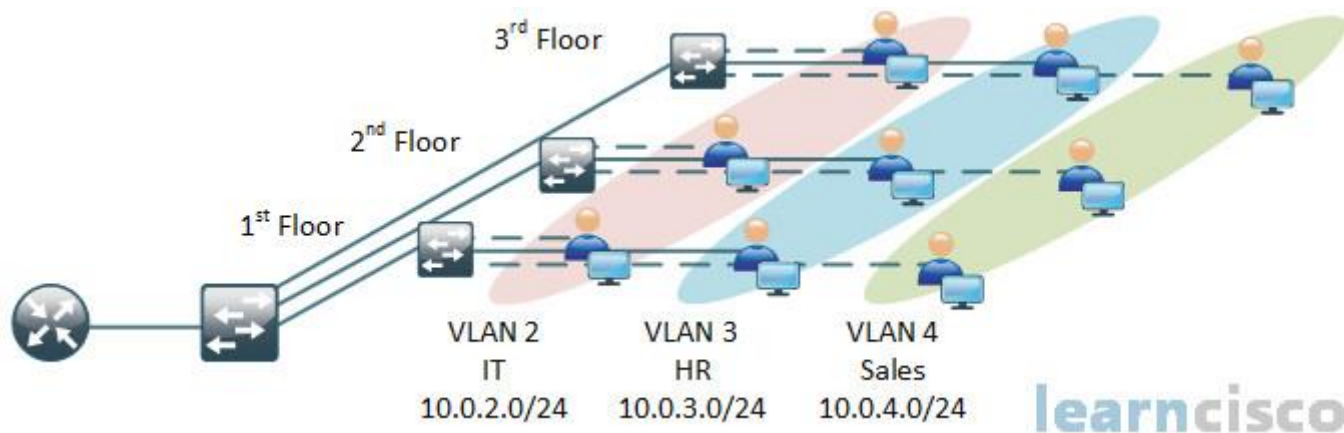
Example of a WAN



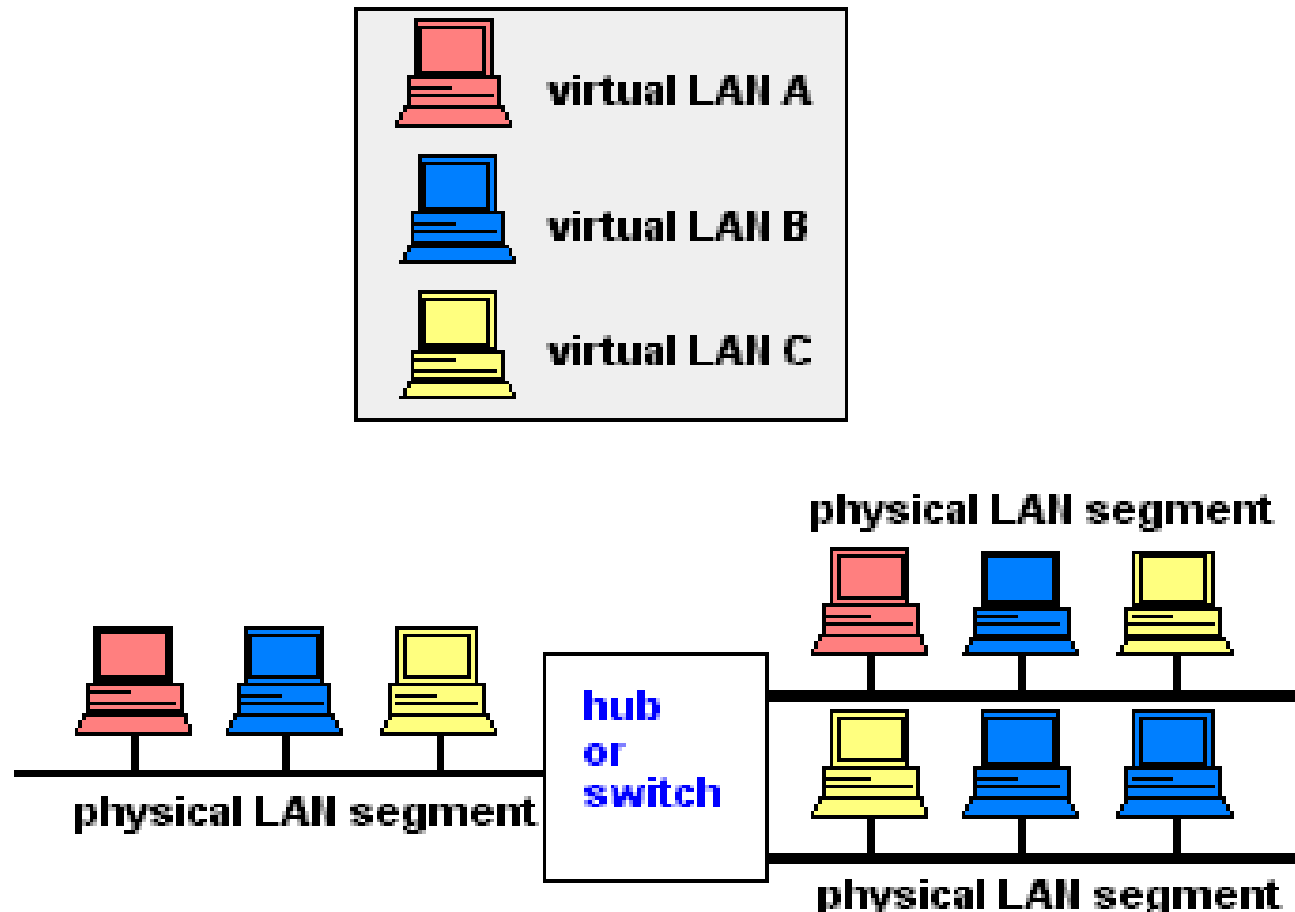
VLAN = Virtual Local Area Network

- A virtual local area network (VLAN) is a **logical group** of workstations, servers and network devices that **appear** to be on the same LAN despite their geographical distribution.
- A VLAN allows a network of computers and users to communicate in a **simulated environment** as if they exist in a single LAN.
- VLANs are implemented to achieve scalability, security and ease of network management and can quickly adapt to changes in network requirements and relocation of workstations and server nodes.

Examples of a VLAN



VLAN vs LAN



SAN = Storage Area Network

- A storage area network (SAN) is a secure high-speed data transfer network that provides access to consolidated block-level storage.
- An SAN makes a network of storage devices accessible to multiple servers.
- SAN devices appear to servers as **attached drives**, eliminating traditional network bottlenecks.
- SANs are sometimes also referred to (albeit redundantly) as **SAN storage**, SAN network, network SAN, etc.



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WLAN = Wireless Local Area Network

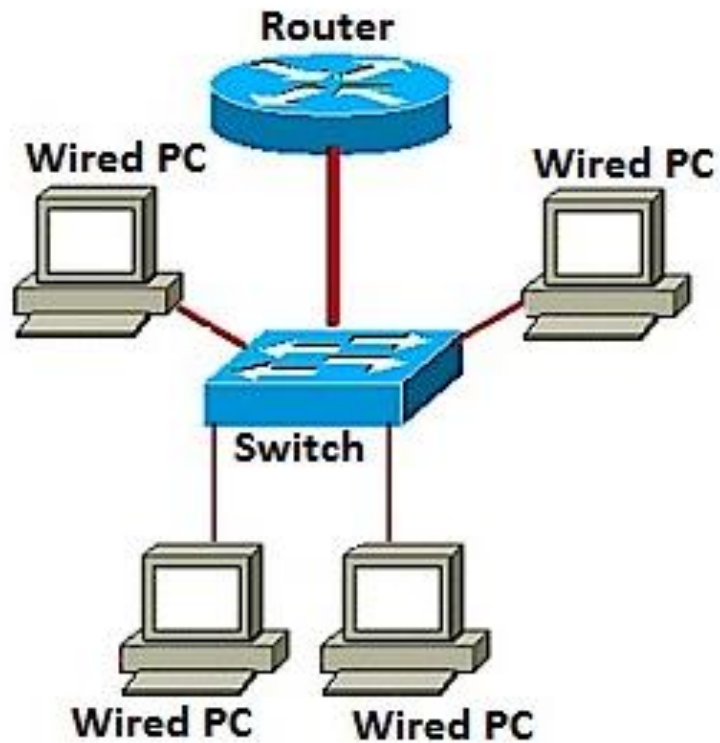
- A wireless local area network (WLAN) is a **wireless distribution method** for two or more devices that use high-frequency radio waves and often include an access point to the Internet.
- A WLAN allows users to **move around** the coverage area, often a home or small office, while maintaining a network connection.
- A WLAN is sometimes called a **Wi-Fi network**, but can include other transmission technologies.



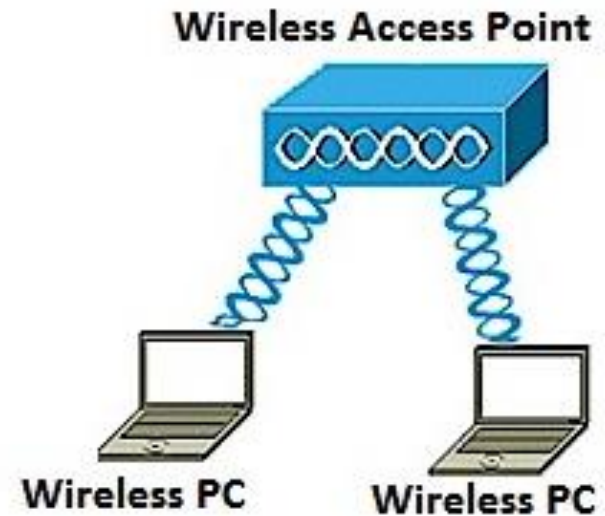


LAN vs WLAN

WIRED NETWORK

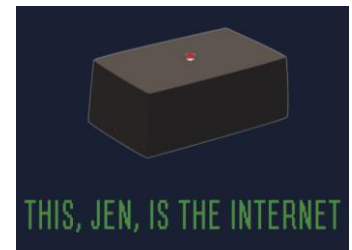


WIRELESS NETWORK



Internet = network of networks

- The internet is a **globally connected network system** that uses the TCP/IP protocols to **transmit data** via various types of media.
- The internet is a network of **global exchanges** – including private, public, business, academic and government networks – connected by wired, wireless and fibre-optic technologies.
- The terms internet and **World Wide Web** are often used interchangeably, but they are not exactly the same thing; the internet refers to the **global communication system**, including **hardware and infrastructure**, while the **web** is one of the **services** communicated over the internet.



2018 *This Is What Happens In An Internet Minute*

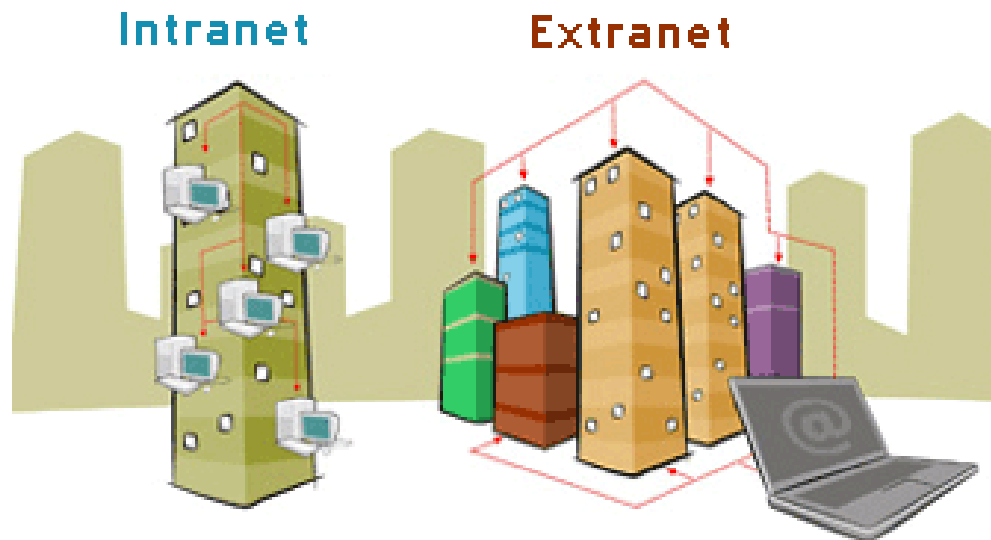


Extranet

- An extranet is a **controlled private network** allowing customers, partners, vendors, suppliers and other businesses to gain information, typically about a specific company or educational institution, and do so **without granting access** to the organization's **entire network**.
- An extranet is often a **private part of a website**.
- It is restricted to select users through **user IDs, passwords** and other authentication mechanisms on a login page.



Intranet vs Extranet



Intranet



A private network, designed to help employees connect, communicate, collaborate and perform their roles

Extranet



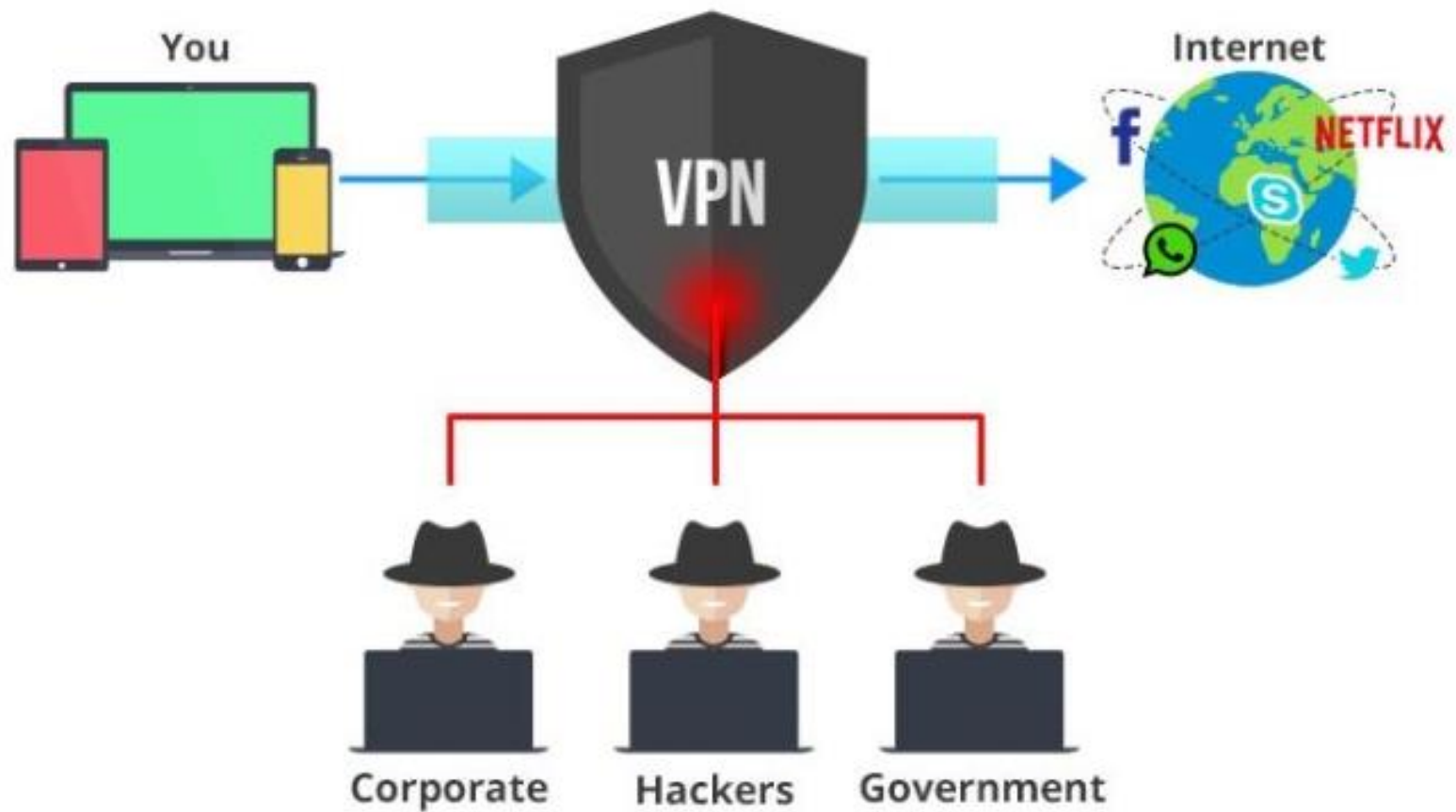
An intranet that also provides controlled access to authorized customers, vendors, partners or external users

VPN = Virtual Private Network

- It uses the internet to allow people to **log into a network remotely** and access its resources, but **encrypts** the connection to thwart eavesdroppers.
- If your company sets you up with a VPN, you can access your corporate intranet, file servers or email from home or a coffee shop – **just as if you were using it in your office.**
- This makes VPN a popular way to support **remote workers**, especially in fields where **privacy** is paramount, such as health care.



VPN

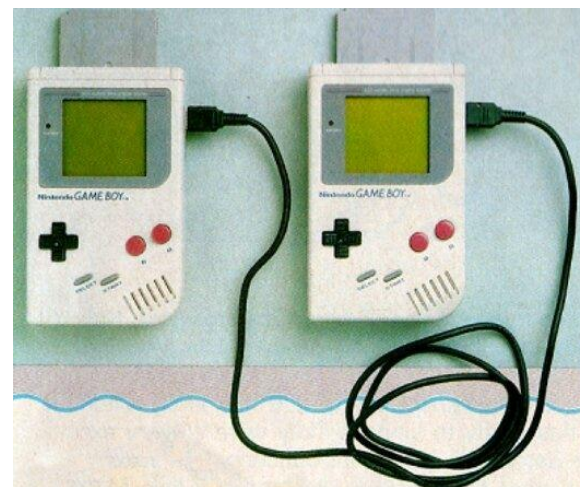


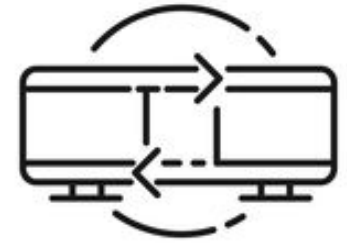


PAN = Personal Area Network

- It's exactly what it sounds like: a **network covering a very small area**, usually a small room.
- The best known wireless PAN network technology is **Bluetooth**, and the most popular wired PAN is **USB**.
- You might not think of your wireless headset, your printer or your smartphones as components in a network, but they are definitely talking with each other.
- Many peripheral devices are actually computers in their own right.
- Wi-Fi also serves as a PAN technology, since Wi-Fi is also used over a small area (especially in cars).

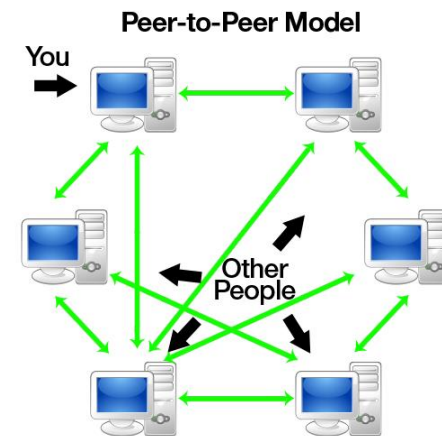
PAN example





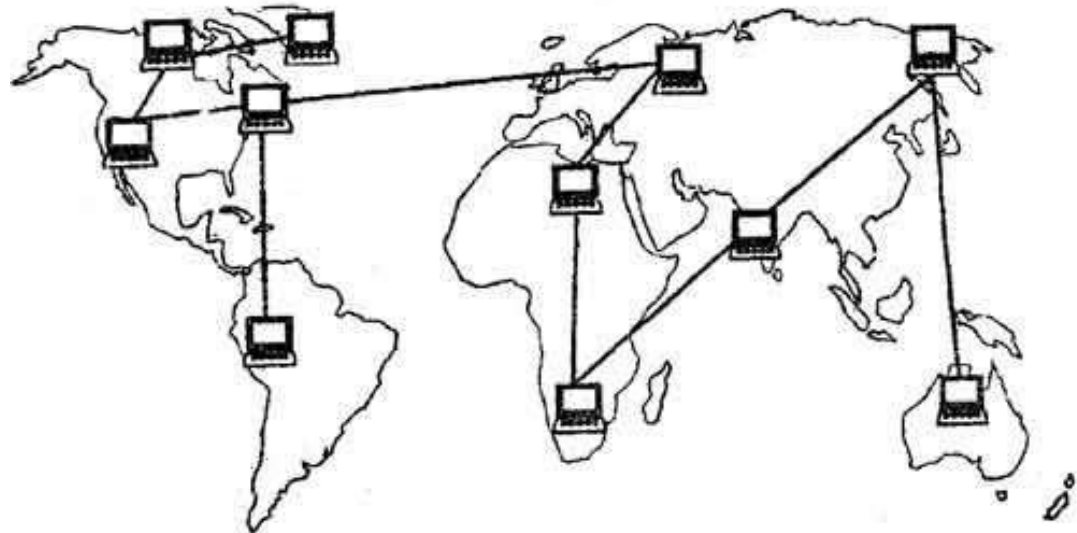
P2P = Peer-to-Peer

- Peer-to-peer is a **network model** in which computers or hardware devices **exchange files**.
- Some experts describe it as an “**equal client**” **system** where instead of accessing files from a server, the “peer” computers just swap them amongst each other.



Types of Networks

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- VPN
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- P2P



Can you appreciate how globalisation has been accelerated by the technical advances linked to network development?