Late 1960s internet developed as a project by the US department of defence.

* Began with ARPANET project
* www invented by tim berners lee in 1989
  + consists of webpages websites and hyperlinks
  + html was the language used for creating these webpages
  + http was the protocol for transferring web data
  + difference between www and internet is internet is more of a global structure while www was more of a network of all the webpages
* 1971 first email was sent
* 2000’s social media and broadband were on the rise
* 2010s – mobile internet, streaming services
* 2020s – 5g networks, IoT, AI

Physical structure

* Consists of data centres, fibre optic cables, submarine cables – under the oceans, carry most of the internet traffic, satellites, and wireless networks
* Backbone of internet – refers to the high capacity network of optical fibres and routers that form the core of the internet

Internet service providers

* Companies that provide users with access to the internet
* E.g Vodafone, Skynet
* Tier 1s own global backbone networks, tier 2 buy wan bandwidth from tier 1s and resell it, there is a tier 3 too.

WANs and LANs

WAN – wide area network – rely on third party carriers and connection therefore large geographical area, high latency since larger area and also therefore more insecure

LAN – local area network – cover small geographical area but faster (lower latency) often seen in small organisations such as schools

Topologies:

* Bus topology – a multipoint communication. All devices are connected to a single central cable.
* Star topology – each device has a dedicated point to point link only though a central node, which is typically a switch or a router
* Bus vs star
  + Bus – all devices share a central cable
  + Star – all devices are connected to a central node
  + Bus - data travels along the bus, all devices receive it, but the unintended computers will ignore it, but this causes security issue since it can be intercepted or stolen since it is sent to every device
  + Star – data is sent to the central node, which forwards it to the intended device
  + Bus – failure of the main cable affects whole circuit
  + Star – failure of one device will not affect another device since everything done through central node
  + Bus – slower due to data collisions, when collisions occur, the two computer attempting to transmit data wait a random amount of time before resubmitting, since if they collide the data corrupts, so that if they wait a random amount of time, they are less likely to collide, unless very unlikely, the random is exactly the same, this repeats.
  + Star – faster as each device is linked to the central node instead of through each other

Physical topology and logical

* Physical – actual physical layout of devices, cables, and connections in a network
* Logical – how data logically flows between devices on the network
* A network can have a different physical and logical topology
* In a star, if a hub is used instead of switch, it just redirects data to every device on network until it finds the right one, which makes it act like a bus effectively, hence outdated and hub is no longer used. Switch instead knows how to directly direct the data to the very intended computer without going through each one.

Wifi

* Allows devices connect to internet and communicate
* Developed by IEEE (institute of electrical and electronics engineers)
* Generations – IEEE standards:
  + 802.11 - 1997
  + 802.11b - 1999
  + 802.11a - 1999
  + 802.11g - 2003
  + 802.11n – wifi 4 - 2009
  + 802.11ac – wifi 5 - 2013
  + 802.11ax – wifi 6 - 2021
  + 802.11ax – wifi 6e – 2021
  + 802.11be – wifi7 - 2024
  + 802.11bn – wifi 8 – 2028 – not out yet
* Frequencies – higher frequency – faster, lower frequency – slower
* Higher frequencies are for shorter range and are less penetrating and experience less interference
* Lower frequencies are for longer ranges since more penetrating and longer range, but higher interference
* Wireless access point – wap is a device that allows wireless devices to connect to a wired network using wi fi,
* Wireless network adapter – hardware that connects to a main device#
* Network interface card – hardware component that enables a computer or device

MAC address

* Is a 48 bit hexadecimal number assigned to each device connected to the network

Mesh network topologies

* Full mesh network topology – every node connected to all other nodes
* Total number of connections is n(n-2)/2
* Expensive due to large number of links required
* Provides a high level of redundancy, data can take many paths to reach destinations, so if one link fails, it can just go a different path
* Partial mesh – every node is connected only to some other nodes
* More practical to implement than full mesh, providing balance between cost, redundancy and efficiency
* In most cases, important devices have more connections, less important have fewer connections
  + Partial is cheaper since fewer cables and equipment, less redundancy and easier to set up, less secure, less efficient, more congestion
  + Full mesh is more expensive since all devices connected to each other, but maximum redundancy though harder and more rigorous to set up. Less congestion, more efficient, more secure
* Full mesh would more likely be used in more important and larger organisations whereas partial mesh will be used for less large organisations.