

NETWORKS

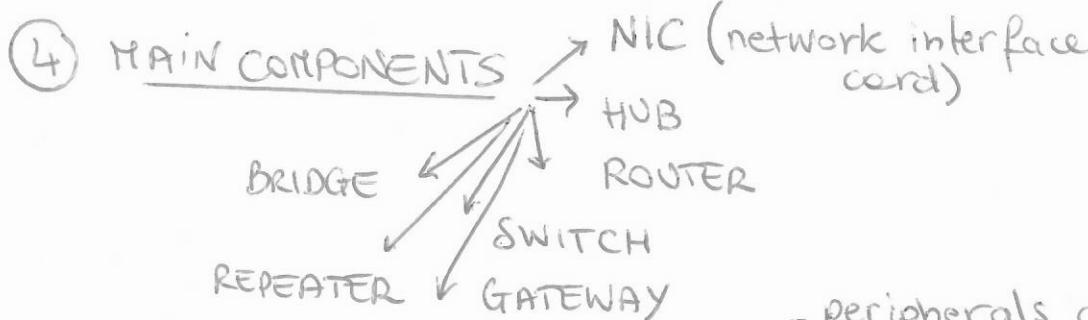
→ ① DEFINITION: a network consists of a number of computers linked together and able to share resources, software, data and even a connection to the internet

↓
② WAYS OF OPERATING A NETWORK

- PEER-TO-PEER → main features (video-lesson)
- CLIENT-SERVER → main features (video lesson)

③ MEDIUM through which data signals can travel from one computer to another

- ↳ metal wires
- ↳ fibre optic cables
- ↳ wireless connection



⑤ Networks have both PROS and CONS

- ⑥
- peripherals can be shared among different computers
 - hardware can be shared among different users
 - hardware is faster to install and faster to maintain and upgrade
 - Communication and transfer of files across the network is very quick
 - Users have access to a central store of data
 - Communication across the network is cheaper than buying software for each stand-alone computer.

- ↓ (−) - cables and servers can be very expensive to install and replace
 - a fault with the server will prevent the whole network from working
 - a network manager is needed and can be quite expensive
 - networks are vulnerable to viruses and hackers.

(6)

Computer networks can be classified according to

SIZE

→ LAN (Local Area Network)

→ to operate within a limited geographical area with cables, wireless, infrared or microwave links. It is controlled privately by a local administrator. It provides full time connectivity to local services and allows multi-access to high-bandwidth media.

TOPOLOGY

on the basis of the layout of the links connecting pairs of nodes.

- A given node has one or more links to others, and the links can appear in a variety of different shapes

BUS
RING
STAR
TREE
LINE
MESH
FULLY-
CONNECTED

3

- features
- advantages / disadvantages

→ HAN (Metropolitan Area Network)

→ designed for a city or a suburban area. It usually consists of 2 or more LANs in a common geographical area. A service provider is usually needed to connect the LAN sites, using private communication lines, fibre optics or Wi-Fi technology.

→ WAN (Wide Area Network)

the Internet itself is a WAN. It allows real-time communication between users and provides full-time remote resources connected to local services together with file transfer and e-mail.

→ it covers a large area, between cities, countries and continents. It connects LANs to each other. Computers are connected by high-speed telephone lines, fibre optical cables, microwave and satellite links.

INTERNET

→ ①

DEFINITION: the word "Internet" is a short word for INTERNETWORKING, which refers to a huge system of interconnected networks

↓ ②

ORIGINS: 1970s: Bob Kahn/Vint Cerf began working on the design of what we now call the Internet

↳ The Internet is the result of an experiment called ARPANET, which was a Defense Department Research Project aiming at the creation of a communication system able to survive a nuclear attack.

↳ the first experiments were based on the idea of breaking messages up into blocks and sending them as fast as possible in every possible direction through the mesh network (\Rightarrow messages could take any of several possible routes from source to destination). In order to prevent a nuclear attack a distributed architecture had to be developed, to replace the already existing centralized one (\Rightarrow a mainframe in charge of the traffic)

↓ ③

Nobody and Everybody
is in charge of the Internet

→ it consists of a very large number of independently operating networks that are fully distributed, so there is no central control deciding how packets are routed or where pieces of the network are built

↓ All the operators involved in the networks want to make sure that there is end-to-end connectivity of every part of the networks so that any device can communicate with any other device.

④ WHAT MAKES THE INTERNET DIFFERENT FROM THE WEB?

→ the Internet supports a lot of services, one of which is the World Wide Web;

↓
it is something like a virtual space where content is stored and accessed using a protocol called http

there are a lot of services that we access via the Internet, which are not part of the Web ↗ non browser-based email services, such as Outlook or some apps, which use different protocols than the Web, which are separated from web traffic because they use different ports than http.

⑤ HOW CAN PEOPLE COMMUNICATE TO SEND INFORMATION FROM ONE PLACE TO ANOTHER?

→ either it is a picture or a music file, or a document, information is always represented as BITS.

Bit = a pair of opposites ↗ ON/OFF
YES/NO ↗ 1/0

BITS can be sent by:

ELECTRICITY
(copper cables)

- ⊕ sending info is very cheap
- ⊖ not fast enough
- ⊖ signal loss

In order to transmit bits faster we need to increase the BANDWIDTH, which is the maximum transmission capacity of a device

LIGHT
(fiber optic cable)

We can send bits as LIGHT BEAMS from one place to another using a fiber optic cable; more bits can be sent simultaneously and all of them travel at the speed of light

RADIO WAVES

(radio signals)

Bits are translated into radio waves of different frequencies.

The receiving machines reverse the process and convert radio waves into binary on your computer

- ↓
- ⊕ very fast
- ⊕ no signal loss \Rightarrow we can send info across the ocean to connect one continent to another
- ⊖ it is a pretty fragile physical system. If a cable is cut the Internet for a huge country is interrupted.
- ⊖ it's really expensive and really hard to work with

- ↓
- ⊕ totally mobile
- ⊖ a radio signal doesn't travel all that far (\Rightarrow short range)

⑥

How is communication possible? \rightarrow In the 1970s there was no standard methods for networks to communicate. Khan and Cerf invented the INTERNET WORKING PROTOCOL to make communication possible.

a) All the different devices on the Internet have a unique address. An address on the Internet is just a number which is unique to each computer or device. The address system for computers on the Internet is a very important part of the protocols used in Internet communication

set of rules and standards used to communicate between machines without troubles

\rightarrow INTERNET PROTOCOL (IP)

IPV4
IPV6

IP ADDRESS = series of numbers organised into a hierarchy

b) DOMAIN NAME SYSTEM (DNS), which associates a domain name with the corresponding IP address

c) Hypertext Transfer Protocol (HTTP)

→ the web browser is the app that you use to access the web pages. When you open the browser and type in the web address (URL) your computer starts talking to the server to ask for a website. The server talks back to your computer in a language called http.

d) Hypertext Markup language (HTML)

GET
request

POST
request

7) HOW CAN HUGE AMOUNT OF DATA BE DELIVERED TO YOU RELIABLY?

information is divided into "packets". Each packet has the Internet address of "where it came from" and "where it is going".

through PACKET INFORMATION ⇒ there are different ways and possibilities to get from one place to another. The way information gets transferred from one computer to another is quite complex because it needs not follow a fixed path.

→ ROUTERS are special computers on the Internet which work like traffic managers to keep the packets moving smoothly through the network.

In order to make sure that all packets are delivered perfectly

TRANSMISSION CONTROL PROTOCOL (TCP) which manages the sending and receiving of data as packets. When the packets arrive TCP does a fully inventory check and sends back acknowledgements of each packet received. If everything has arrived, TCP signs end your information is done

→ if some packets are missing, TCP won't sign and the packet is re-sent by the original source

8) PROBLEMS WITH THE INTERNET:

- it's completely open
- connections are shared
- information is sent in plain text

this makes it possible for hackers to snoop on any personal information that you send



In order to share information in a safe way you can use a

- SECURE SOCKETS LAYER (SSL)
- TRANSPORT LAYER SECURITY (TLS)

9) SERVICES:

The internet offers different services, which can be divided into five big categories.

COMMUNICATION

- emailing
- social networks
- blogging

E-COMMERCE

- B2B
- B2C
- C2C
- C2B



LEISURE

- gaming
- reading
- music and entertainment (films, TV series)
- social networks

EDUCATION

- wikipedia
- forums

INFORMATION RETRIEVAL

- Wikipedia
- Browsing VS Searching
- Indexes
- search engines