ANDIJAN STATE PEDAGOGICAL INSTITUTE

Lecture materials · 2026–2027 academic year

SUBJECT

Information Systems and Digital Technologies

Lecture 16 · Internet and WWW

Part 1 of 2 · 2 hours

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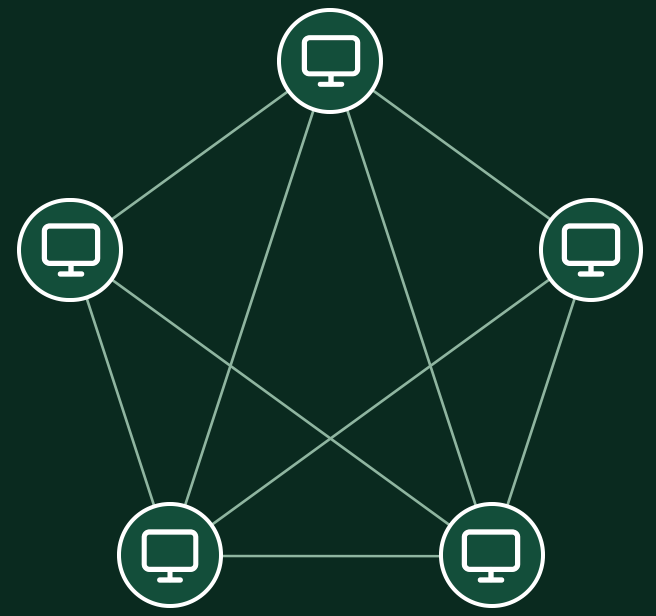
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LECTURE 16 · 2 HOURS · PART 1/2

FUNDAMENTALS OF COMPUTERS · CHAPTER 14

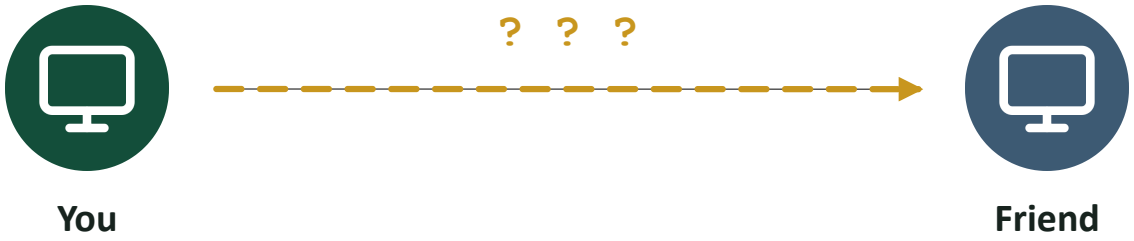
Data Communications and Networks

How computers talk, share and connect the world



Every computer linked to every other: a mesh

Your message just reached a friend in another city. How?



Draw the path: which devices, cables or signals might the message pass through?

Phone · Wi-Fi router · cables · towers · satellites · servers

Think – Pair – Share (3 min)

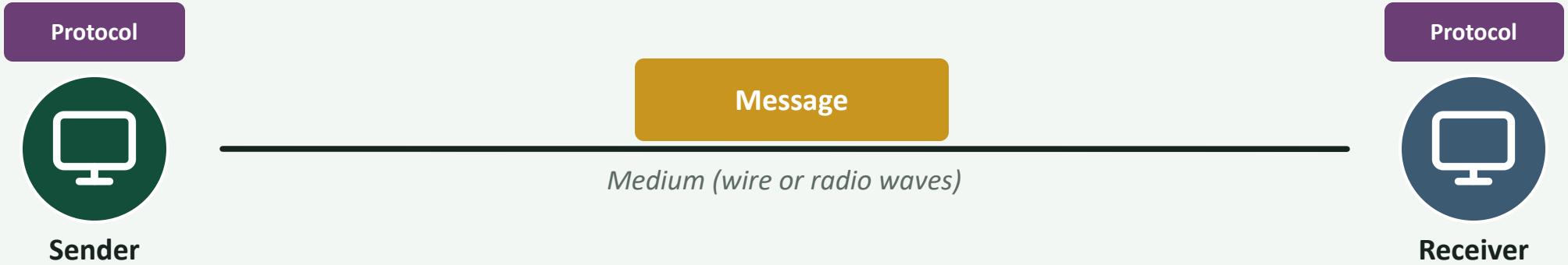
1. Who is the sender and who is the receiver?
2. What carries the message between them?
3. Why must both phones follow the same rules?

By the end of this lesson, you can…

1. **Name** the five elements of data communication and explain what a modem does.
2. **Compare** LAN, MAN, WAN, the Internet and an intranet.
3. **Distinguish** client-server, peer-to-peer and value-added networks.
4. **Draw and evaluate** the six network topologies.
5. **Describe** network media, protocols and everyday uses of networks.

Data communication: five elements

Data communication = the electronic transfer of information between two locations.



Message

the information: text, pictures, audio, video

Sender

the device that creates and sends it

Receiver

the device that receives it

Medium

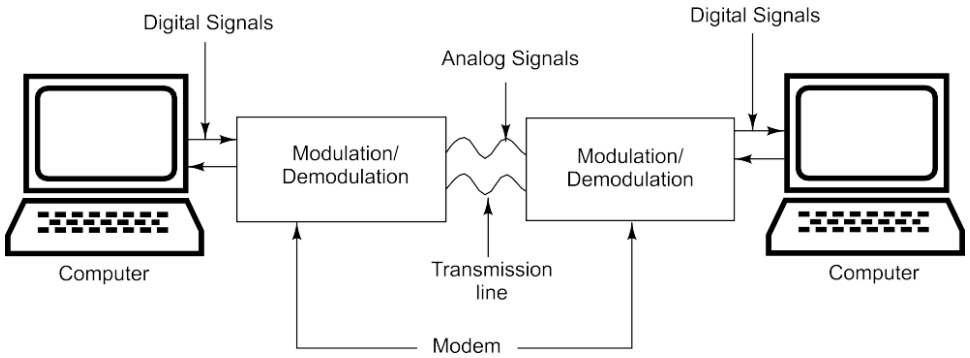
the channel it travels through

Protocol

the rules both sides follow

Redrawn after textbook Fig. 14.1

The modem: digital ↔ analog



Data communication through modems — textbook Fig. 14.2

Modulation

`digital → analog`

at the sender, so data can travel on telephone lines

Demodulation

`analog → digital`

at the receiver, so the computer understands it

MOdulator + DEModulator. Both computers need one.

Speed: measured in bits per second (bps)

Type: internal (on an expansion board) or external (cable to the COM port)

CHECK FOR UNDERSTANDING

Label the communication

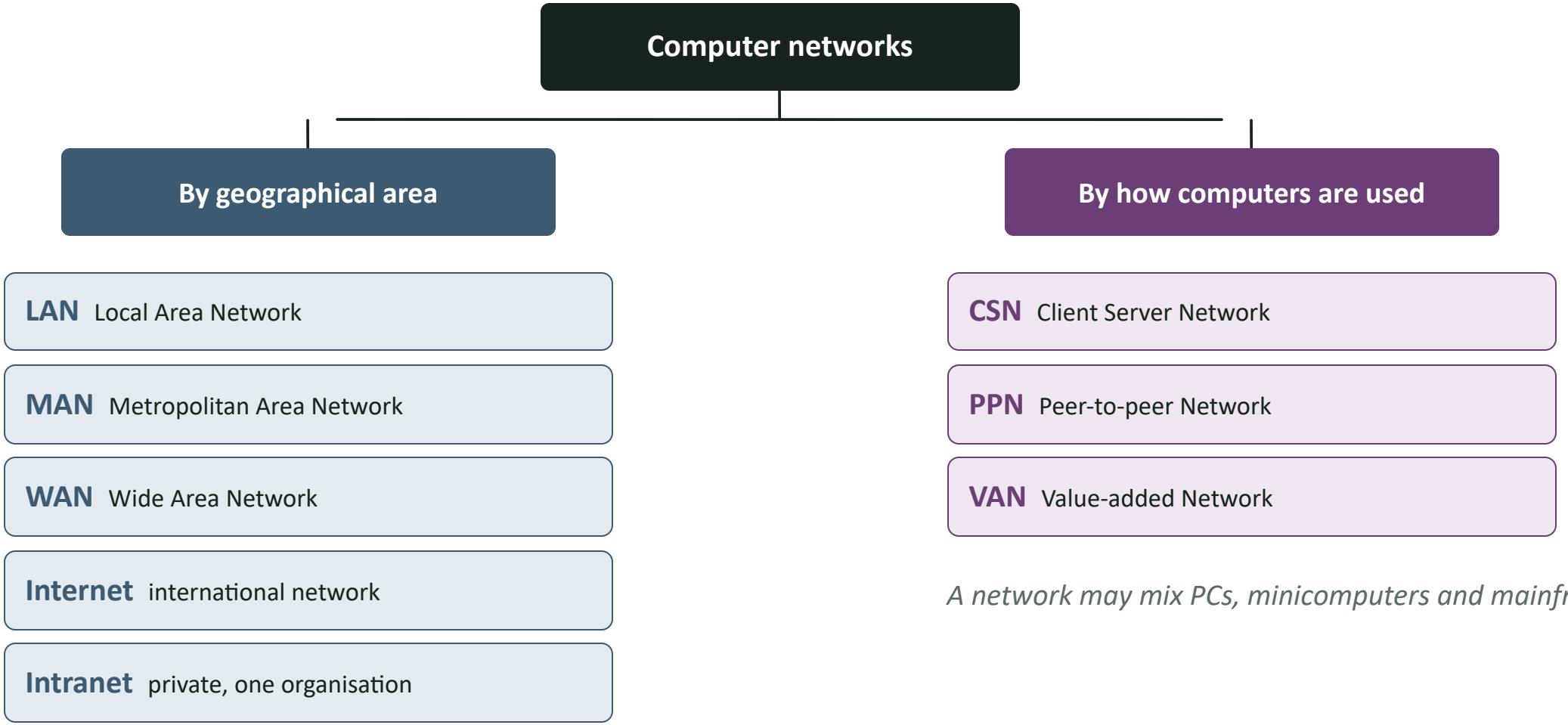
Aziz e-mails a photo to his teacher over a Wi-Fi network.

1. What is the message?
2. Who/what is the sender? The receiver?
3. What is the medium?
4. What makes both devices understand each other?

True or false?

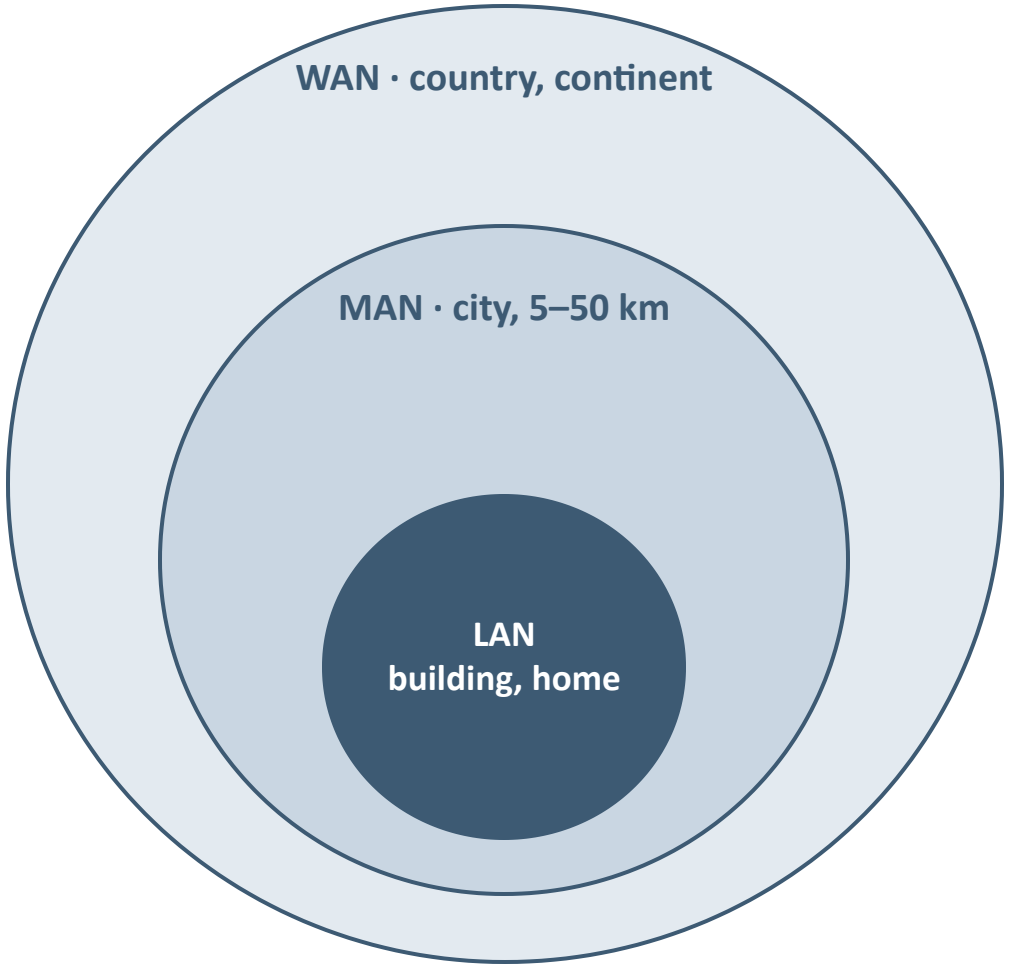
5. Modulation turns digital signals into analog signals.
6. Only the sending computer needs a modem.
7. Modem speed is measured in bits per second.

Computer networks: sharing resources and data



A network may mix PCs, minicomputers and mainframes.

LAN, MAN and WAN: it depends on the distance



	LAN	MAN	WAN
Covers	a building or home	a city (5–50 km)	a country or continent
Media	twisted pair, coaxial cable	optical fibre, copper wire	leased telephone lines, microwave, satellite
Speed	extremely fast	between the two	slow
Example	school computer lab	city cable-TV network	linking a company's LANs across countries

A router joins LANs and directs packets to the right destination.

The Internet: a network of networks

A global network that shares resources and information using protocols such as TCP/IP.

E-mail

Works even when the other person is offline. Address: username@hostname

Online chat

One-to-one; both people must be online

Online shopping

Shopping cart to choose items, e-cash to pay

Usenet

Newsgroups for sharing views on a topic

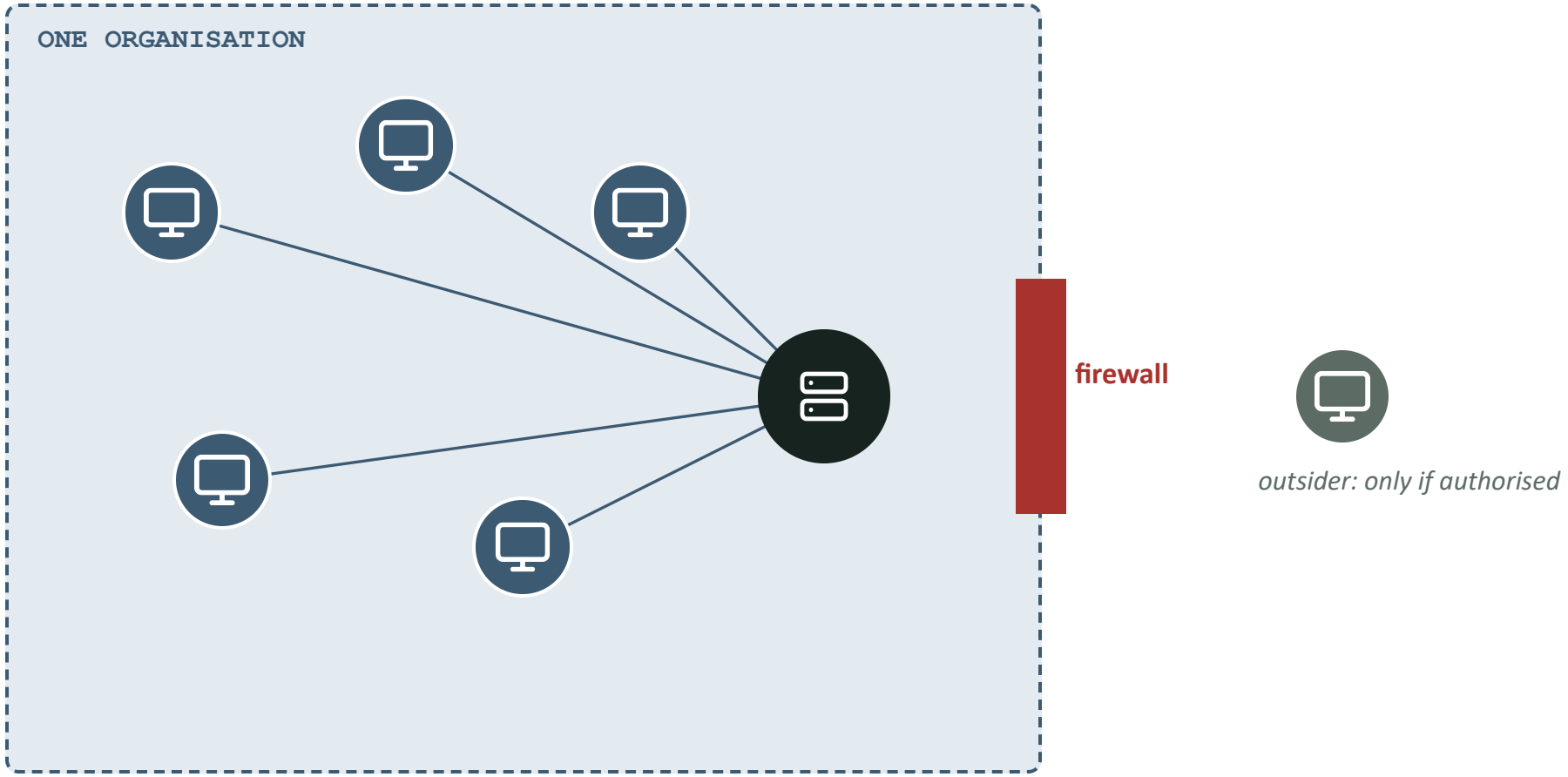
+ Advantages

Information on any topic · **Availability** at any time · **Low cost** — e-mail is cheaper than post

– Disadvantages

Hacking — illegal access to personal data · **Viruses** destroy stored information · **Bulk e-mail** — unwanted ads

An intranet: the Internet's private cousin



Uses TCP/IP, HTTP

Tunneling sends private messages

Firewall protects information

+ Advantages

- Quick access to company info
- Easy staff communication
- Easier to set up than the Internet

CHECK FOR UNDERSTANDING

Which network?

Thirty computers in one school building share a printer.

A cable-TV network links homes across one city.

A company links its offices in Tashkent, Dubai and London.

Only a bank’s staff can open its internal news website.

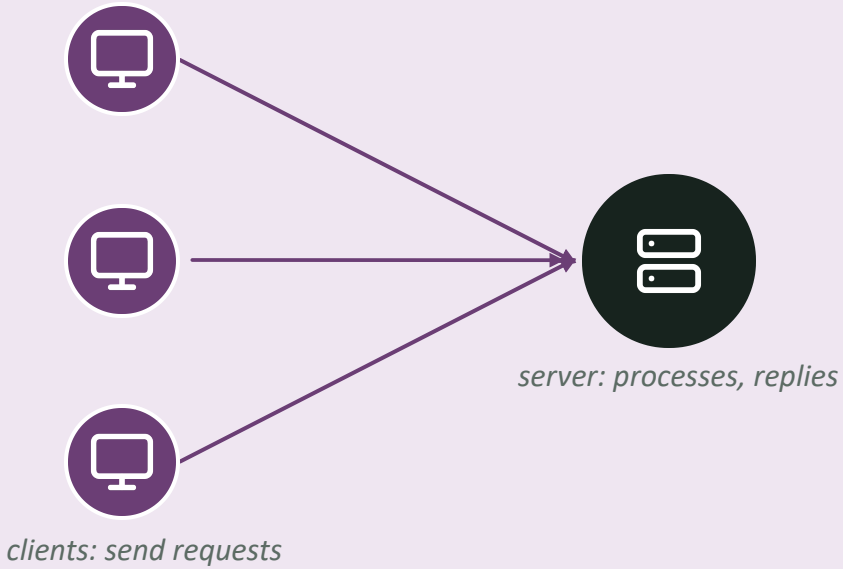
You e-mail a friend in another country.

Choose from

- **LAN**
- **MAN**
- **WAN**
- **Internet**
- **Intranet**

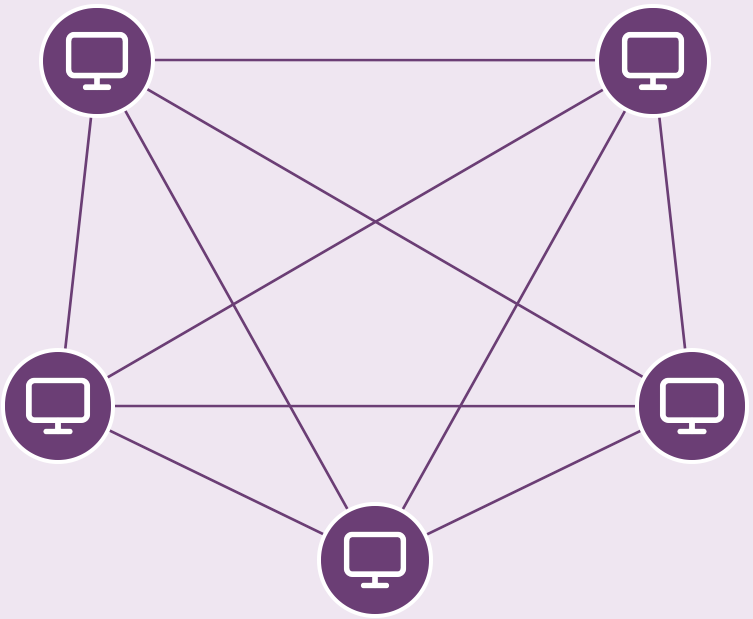
Client–server vs peer-to-peer

Client Server Network (CSN)



+ secure, central data, easy updates
– server crash stops everything; congestion

Peer-to-peer Network (PPN)



+ cheaper, simpler — no server
– less secure; slows as it grows

Value-added networks: networks for business data



Value-added services

e.g. converting XML data into EDI format

Error detection & correction

finds errors in sent data and fixes them

Protocol conversion

a protocol converter changes a message from one protocol to another

CHECK FOR UNDERSTANDING

CSN, PPN or VAN?

A There are no clients and no servers — every computer is equal.

B If one central computer crashes, the whole network stops.

C Companies exchange business data using EDI.

D It is cheaper because no central server is needed.

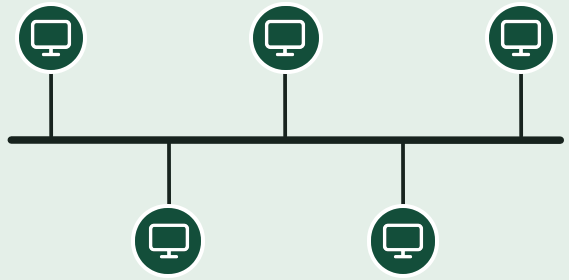
E Only authorised people can reach the important data on one machine.

F It converts a message from one protocol to another.

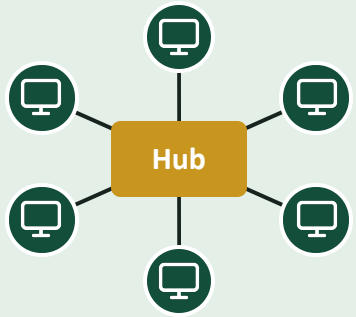
Topology: the shape of a network

How the computers (nodes) are arranged and linked by cable or fibre.

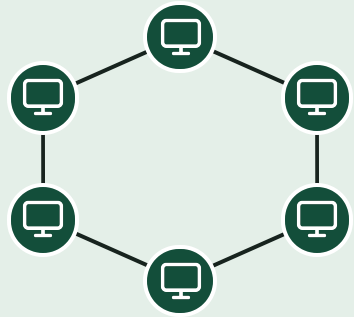
Bus



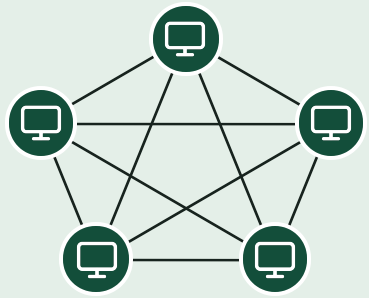
Star



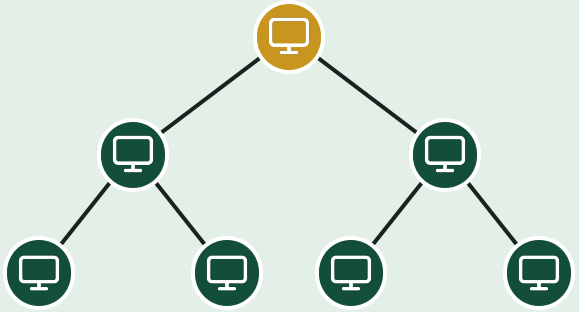
Ring



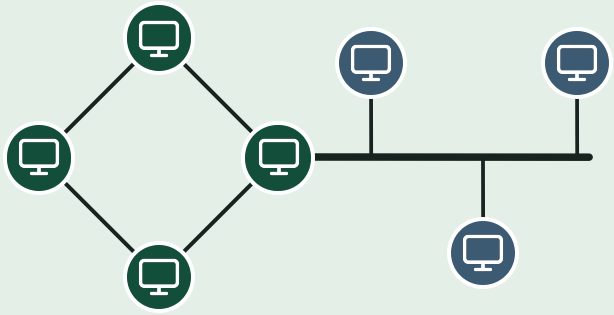
Mesh



Hierarchical (tree)

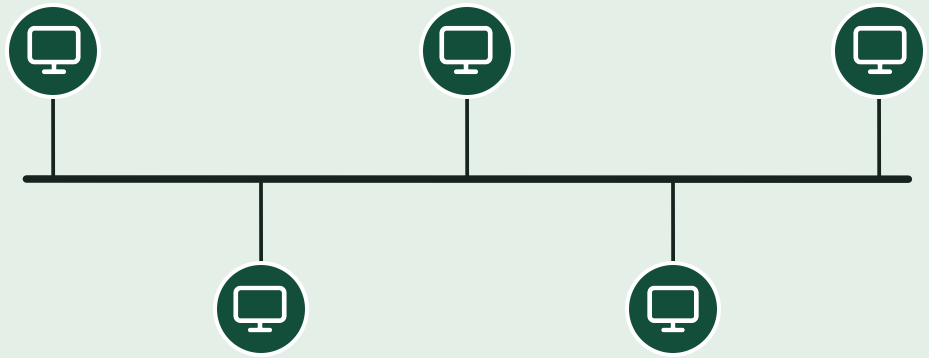


Hybrid



Bus and star

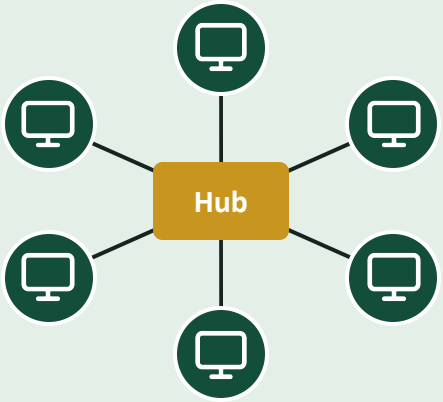
Linear bus



All nodes share one backbone cable. Every node gets the message; only the addressee processes it.

- Least cabling
- Simple to install
- One PC failing doesn't stop the rest
- Backbone failure breaks everything
- Slower as PCs are added
- Hard to repair faults

Star

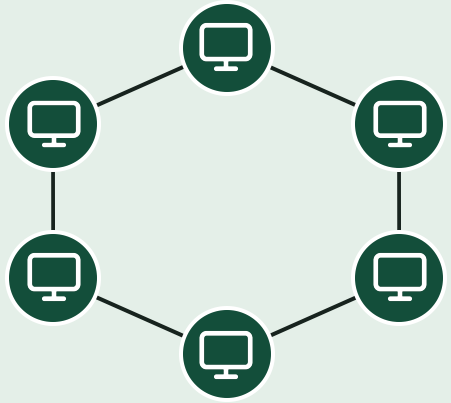


All nodes link to a central hub, which forwards messages and detects faulty nodes.

- Easy error detection
- One PC failing doesn't stop the rest
- Easy to install
- Hub failure crashes the network
- Needs more cable
- Hub adds cost

Ring and mesh

Ring

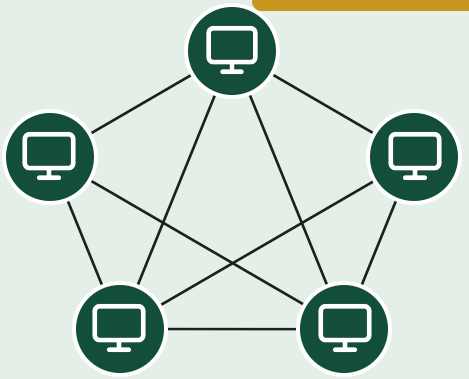


Each node links to two neighbours. Data travels clockwise; each node's repeater passes it on.

- Equal access for every node
- Adding nodes doesn't slow it
- Easy to configure
- Expensive to build
- One node failing affects the others

Mesh

```
links = n(n − 1) ÷ 2
```

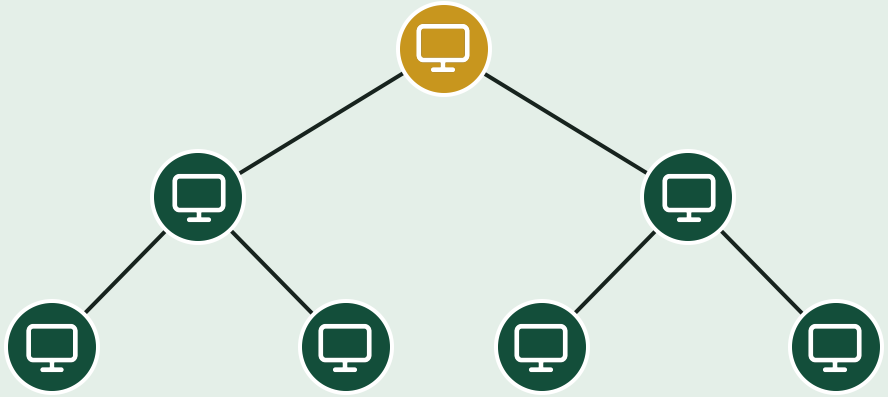


Every computer links to every other. Messages can take many paths.

- Most reliable delivery
- Least congestion
- Very expensive
- Hard to configure and install

Hierarchical (tree) and hybrid

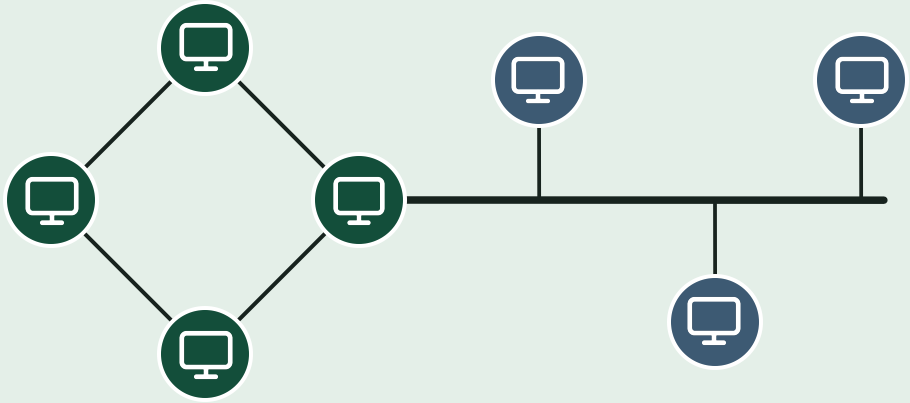
Hierarchical (tree)



A root node at the top; each lower node has one parent. Links = nodes − 1.

- Supported by most hardware and software
- Data reaches nodes efficiently
- Root failure crashes the network
- Difficult to configure

Hybrid



Two different topologies joined, e.g. a ring connected to a bus. (Two rings joined is NOT hybrid.)

- Most effective: combines the best features
- Most complex
- Hard to install and configure

Topologies at a glance

	Bus	Star	Ring	Mesh	Tree	Hybrid
Built around	one backbone cable	a central hub	a closed loop	links between every pair	a root node	two different topologies
If one PC fails	others keep working	others keep working	others are affected	other paths are used	root failure = crash	—
Single weak point	backbone cable	hub	any node	none	root node	—
Cabling / cost	least cable	more cable; hub cost	expensive	very expensive	—	complex
Best feature	simple, cheap	easy error detection	equal access	most reliable	widely supported	best of both

"—" = the textbook doesn't say.

CHECK FOR UNDERSTANDING

Topology puzzles

A The hub breaks and no one can connect. Which topology?

B The single backbone cable is cut. Which topology?

C Messages travel clockwise, node to node. Which topology?

D How many links does a mesh of 5 computers need?

E A tree network has 9 nodes. How many links does it have?

F A star is joined to a bus. What is the result called?

Network media: what carries the signal

Twisted-pair cable

Insulated wires twisted to reduce noise. Links hubs to nodes in a star.

Coaxial cable

One copper conductor with a shield. Very robust; used over long distances.

Optical fibre

Thin glass strands carrying pulses of light. Huge capacity, very fast, highly secure.

Microwave

Links distant ends; WANs use it to join LANs. Affected by weather.

Satellite

Sends signals globally — from one country to another.

OPTIONAL MODERN NOTE The book says coaxial cable crosses oceans; today undersea cables are optical fibre. Most home networks also use Wi-Fi (radio waves).

Protocols: the rules — packets: the pieces

PACKET SWITCHING



Each packet carries the sender's and receiver's addresses. Routers and switches forward it.

PROTOCOLS HELP TO…

- Identify the physical connection
- Detect and correct errors
- Start and end a session
- Format messages

HTTP web pages	**SMTP** sending e-mail	**FTP** transferring files	**TCP/IP** Internet data	**Telnet** remote log-in	**DNS** names → addresses

Network operating system: controls network traffic and access to shared printers and files; multi-user and multitasking.

What networks let us do



Data sharing

Data kept on servers for many users. A locking system stops two people changing it at once. Sharing interactively = data conferencing.



Remote data access

Reach data from a distant location through special software.



Resource sharing

Share storage and I/O devices — e.g. one printer on the server for everyone. Cheaper than a printer per PC.



Personal communication

E-mail, and teleconferencing: seeing and hearing people at other sites in real time — a virtual meeting.

CHECK FOR UNDERSTANDING

Protocol, medium or application?

The whole class prints to one printer attached to the server.	Name it: _____
Teachers in three cities meet on a live video call.	Name it: _____
A large project file is uploaded to a server using this protocol.	Name it: _____
Data travels as pulses of light through glass strands.	Name it: _____
A message is split into pieces, each with both addresses.	Name it: _____

Networks around you



TEXTBOOK

Computer lab sharing one printer

→ **LAN + resource sharing**



TEXTBOOK

City cable-TV network

→ **MAN**



TEXTBOOK

Online shopping with a cart

→ **Internet service**



TODAY

Home Wi-Fi router

→ **Star topology (wireless)**



TEXTBOOK

Video lesson with another school

→ **Teleconferencing**



TODAY

Phone-to-phone file sharing

→ **Peer-to-peer**

Review: can you answer these?

01 Name the five elements of data communication.

02 What is the difference between modulation and demodulation?

03 Put LAN, WAN and MAN in order of size.

04 How is an intranet different from the Internet?

05 Give one advantage and one disadvantage of a CSN.

06 Which topology fails if its hub fails? If its backbone fails?

07 How many links does a mesh of 6 computers need?

08 Which medium uses light pulses, and why is it used?

Exit ticket

Answer on a slip of paper before you leave.

1. What does a modem do at the sender, and what does it do at the receiver?

2. Your school’s 40 computers in one building are connected. Which type of network is this?

3. Sketch a star topology. What happens if the hub fails?