

Data Communication

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ບົດຮຽນພາສາລາວ

<https://pinkeo-garden.netlify.app/introduction-to-data-communication>

Grading Policy

Assignment	20%
Midterm Exam	30%
Final Exam	40%
Attending Class	10%

List of Studied Topics

Basic of Communication:

Introduction, Signal, Digital Transmission, Analog Transmission, Multiplexing, Transmission Media

Standard of Communication Protocol:

Network Model (TCP/IP) and OSI model

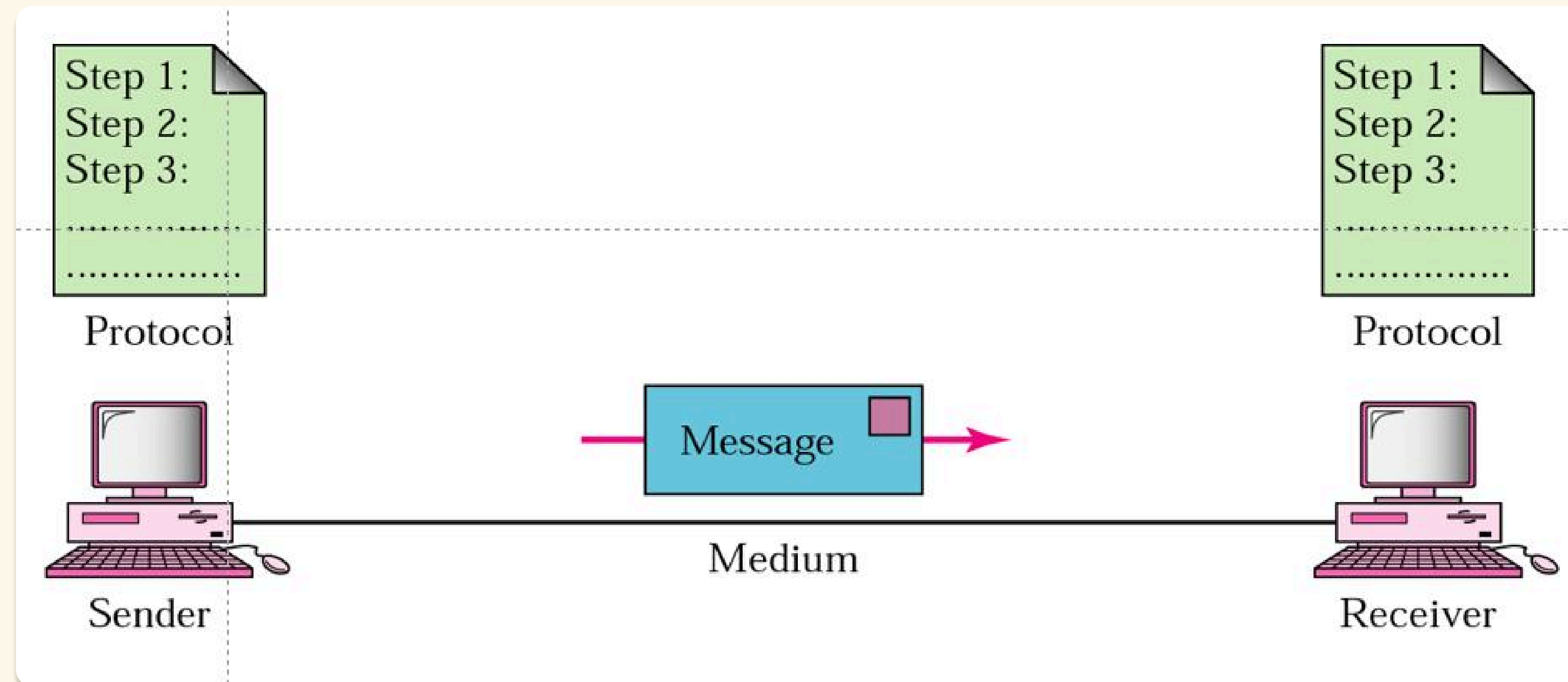
Switching, Telephone Network, and High Speed Digital Access

Data Flow Control:

Error Detection & correction, Flow Control, Point to Point Access, Multiple Access, LAN, Wireless LAN

Data Communication Component

ອົງປະກອບຂອງການສື່ສານຂໍ້ມູນ



Protocol

ຊ່ອງທາງ ຫຼື ກົດ ໃນການສົ່ງຂໍ້ມູນ

WiFi, Bluetooth, TCP/IP, HTTP...

Sender

ຜູ້ສົ່ງ

Computer, Phone

Data

ຂໍ້ມູນ

Images, message, text, audio, video, document ...

Medium

ຕົວກາງ

Wire, Wireless

Receiver

ຜູ້ຮັບ

Computer, Phone

Data Representation

ການສະແດງຂໍ້ມູນ

Text

ຕົວໜັງສື

ASCII (8 bits): American Standard Code for Information Interchange

Unicode (16 bits): Represents symbols belong to languages other than English

Images

ຮູບພາບ

Videos

ວິດີໂອ

Audio

ສຽງ

ASCII

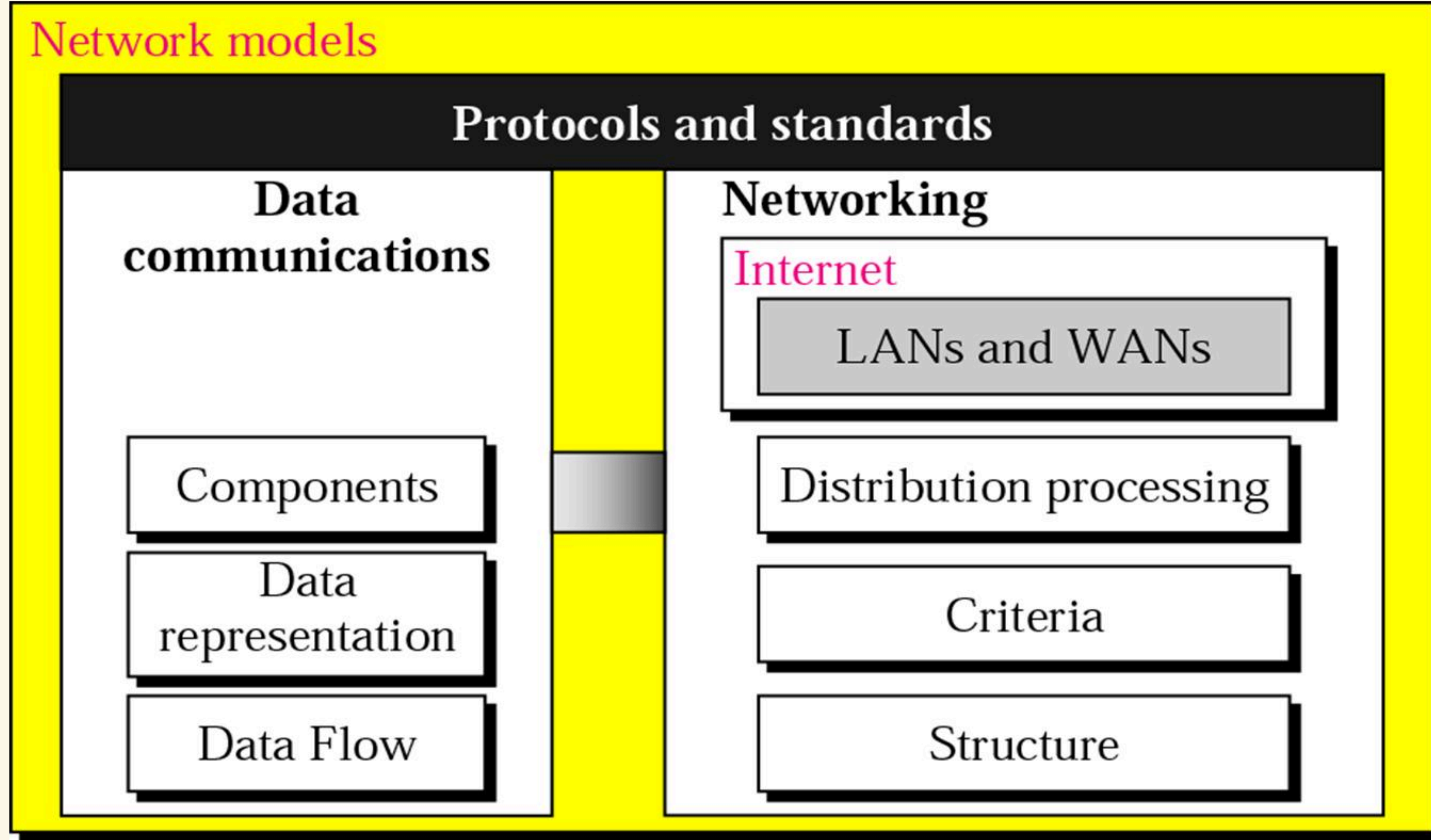
Decimal	Binary	Character
65	01000001	A
97	01100001	a
150	10010110	–

Unicode

Unicode Code Point	Binary	Character
U+0041	00000000 01000001	A
U+03A9	00000011 10101001	Ω
U+1F60A	11011000 00111101 11011100 00001010	😂

Unicode

Network Model

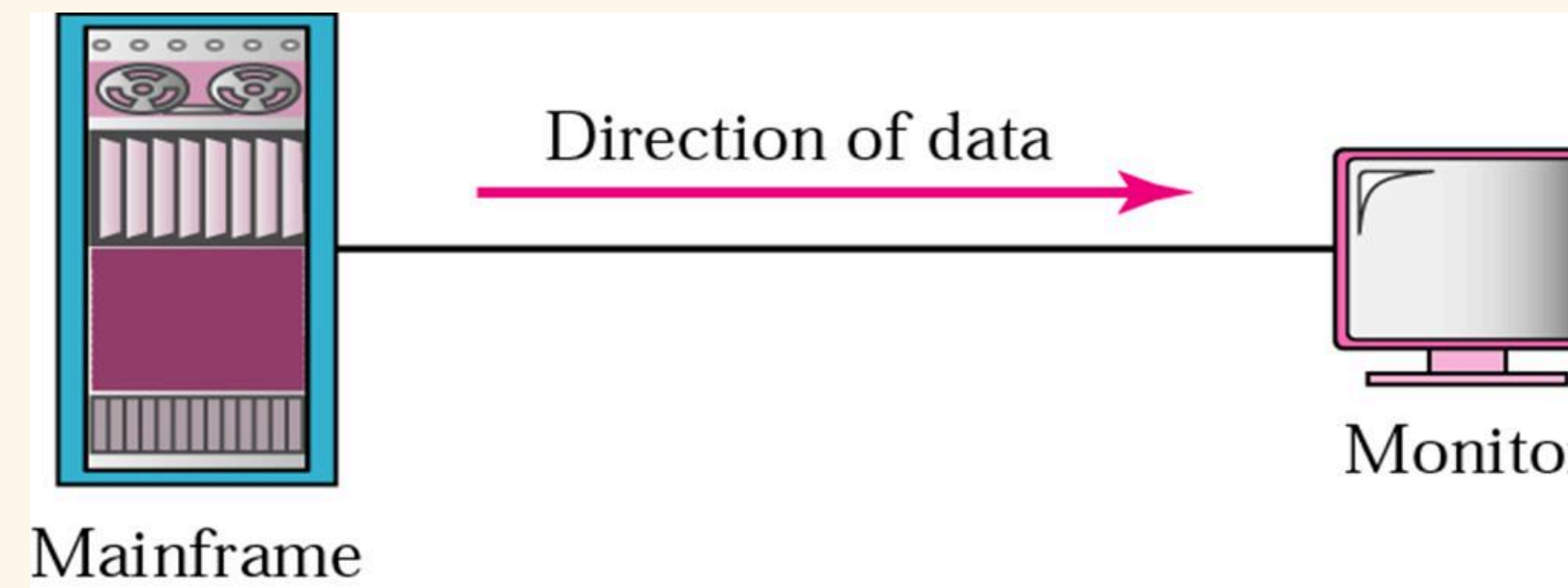


Direction of Data Flow

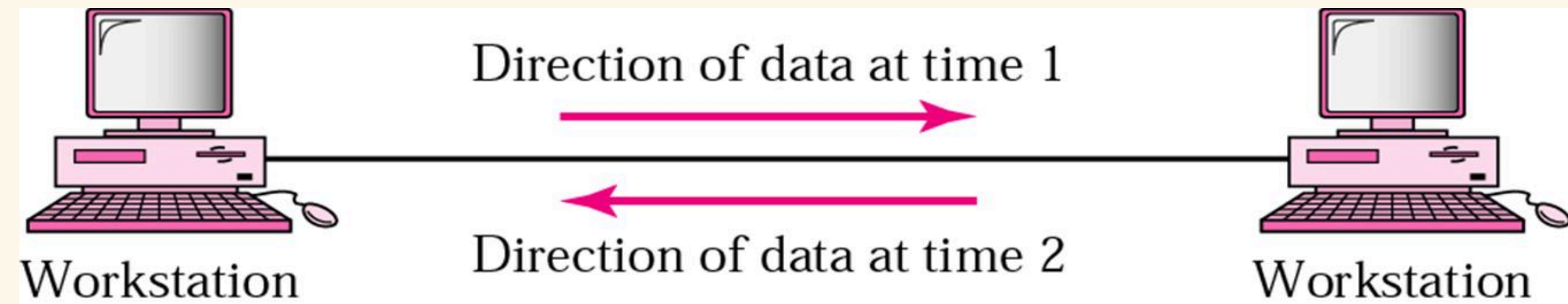
between two devices

ທິດທາງການສົ່ງຂໍ້ມູນລະຫວ່າງ 2 ອຸປະກອນ

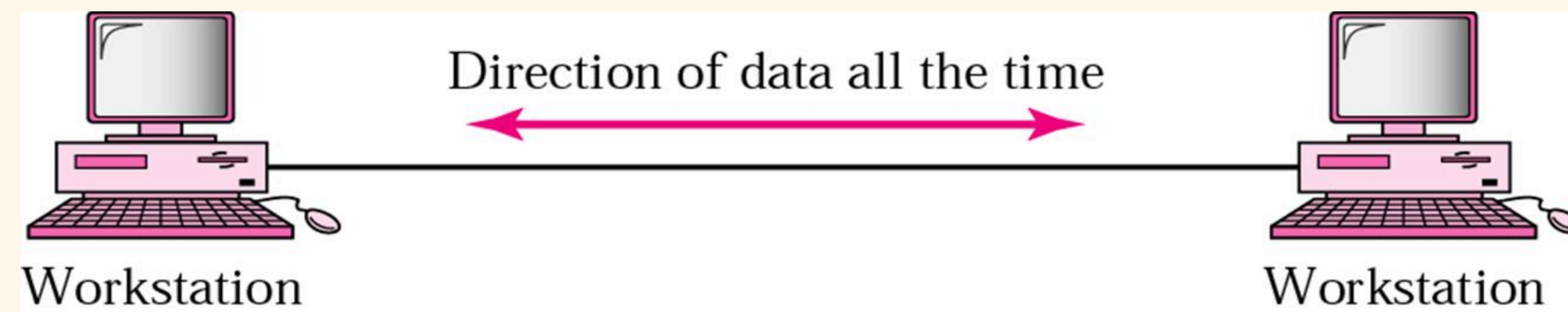
Simplex



Half-Duplex



Full-Duplex



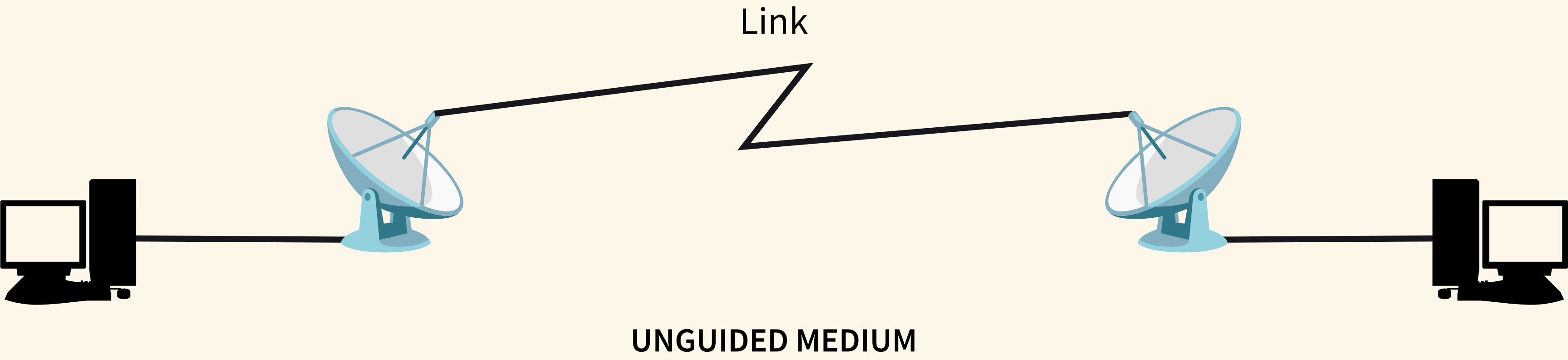
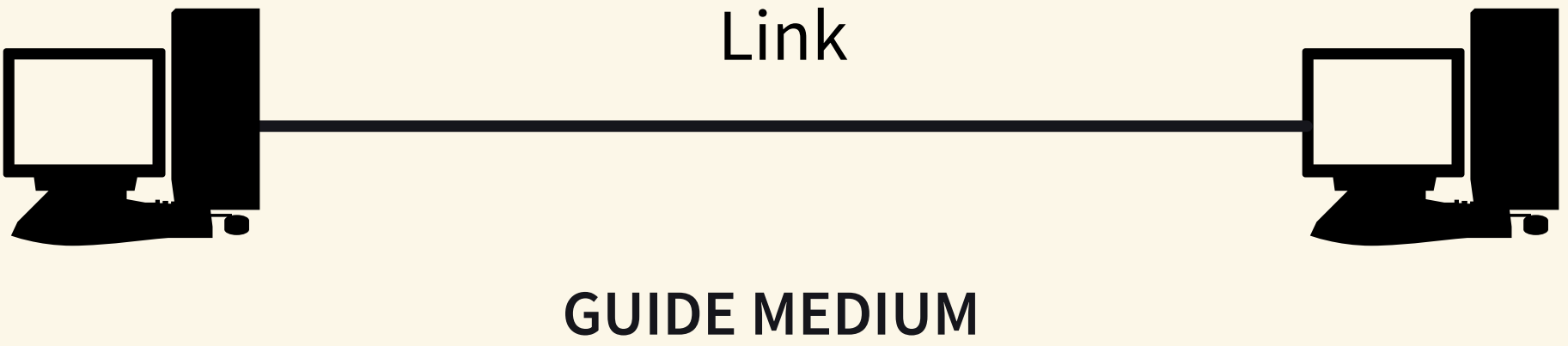
Networks

Physical Structure

Categories of Networks

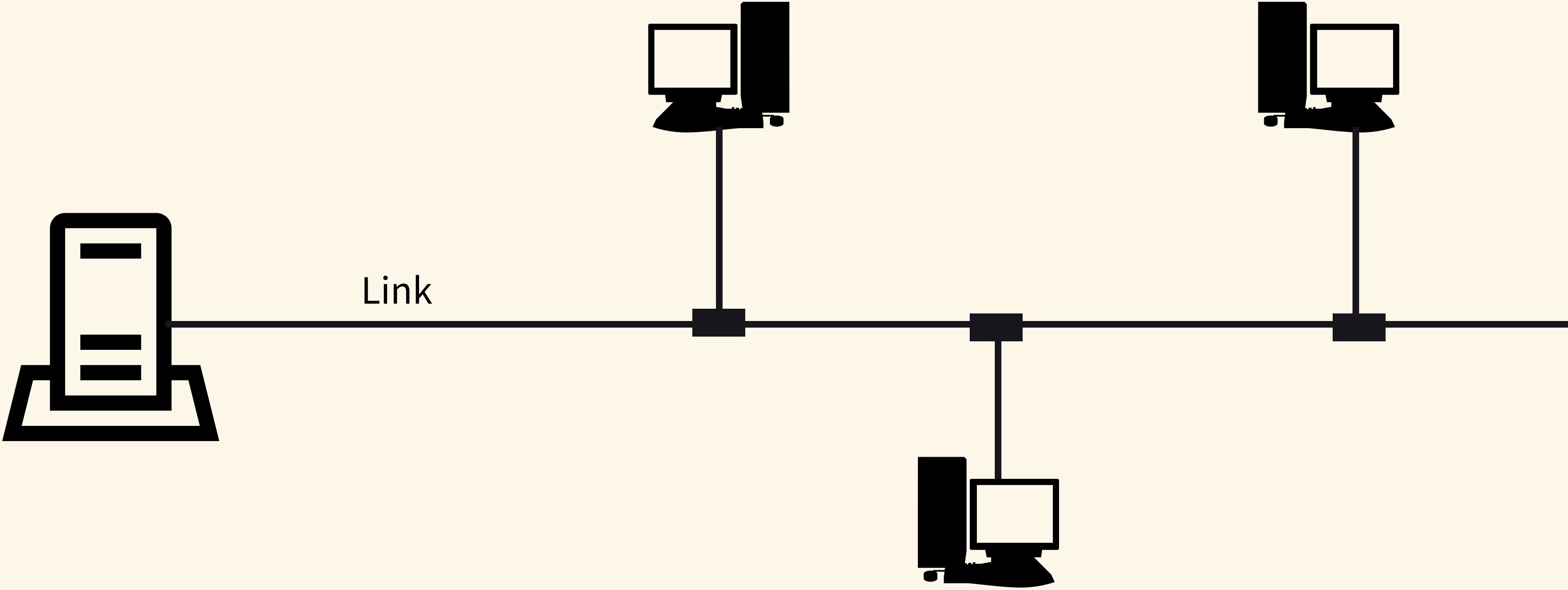
Physical Structure

Point to Point Connection



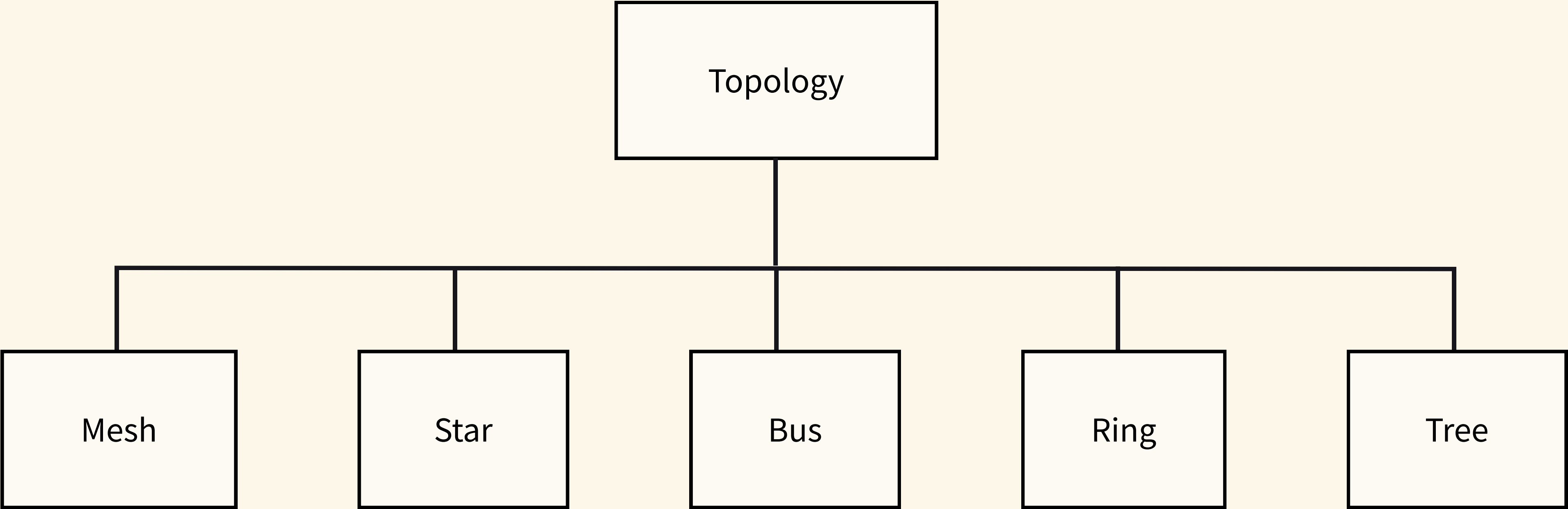
Physical Structure

Multiple Connection

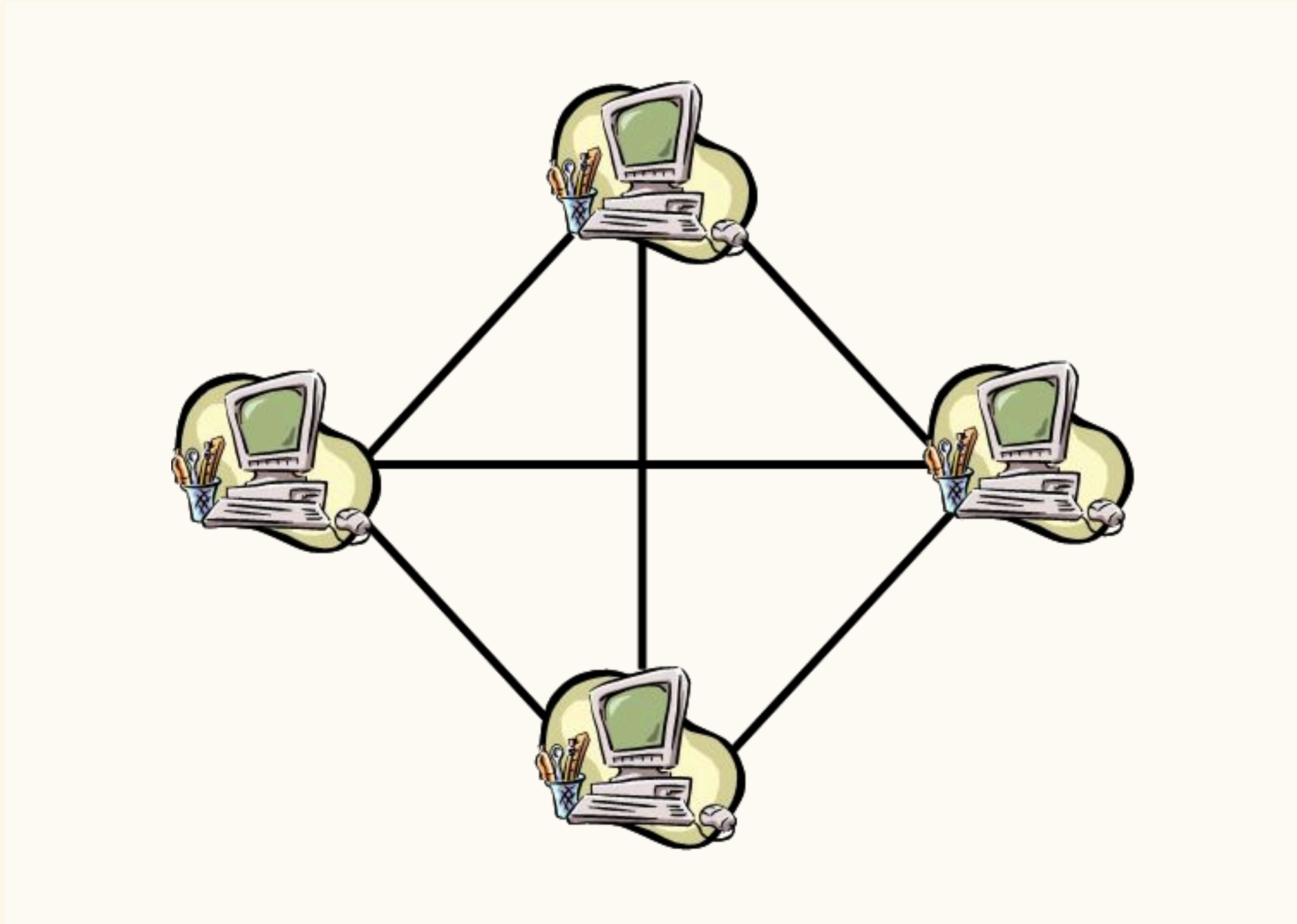


Physical Structure

Category of Topology



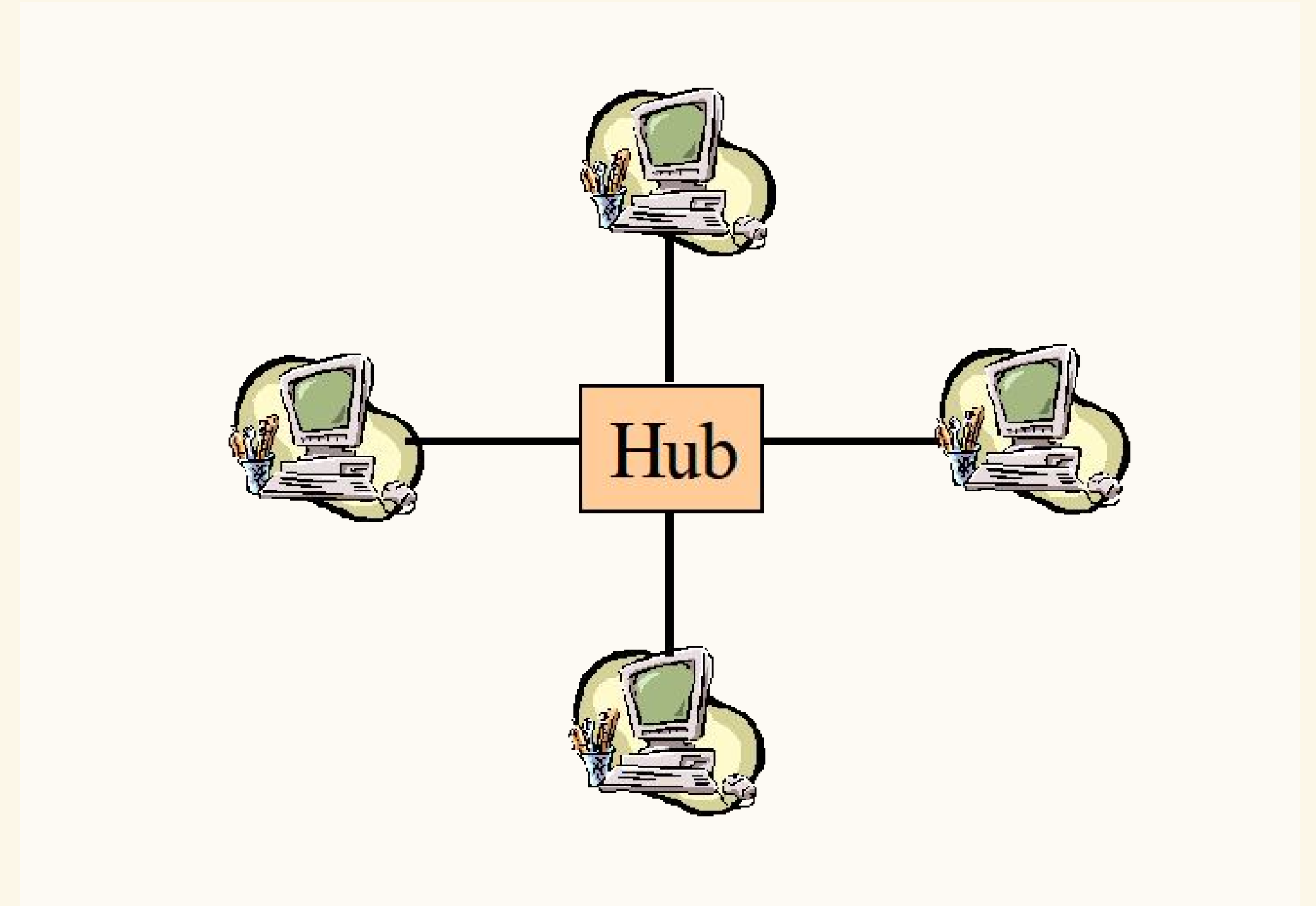
MESH TOPOLOGY



Every device is connected to every other device

Data takes multiple possible routes to reach the destination

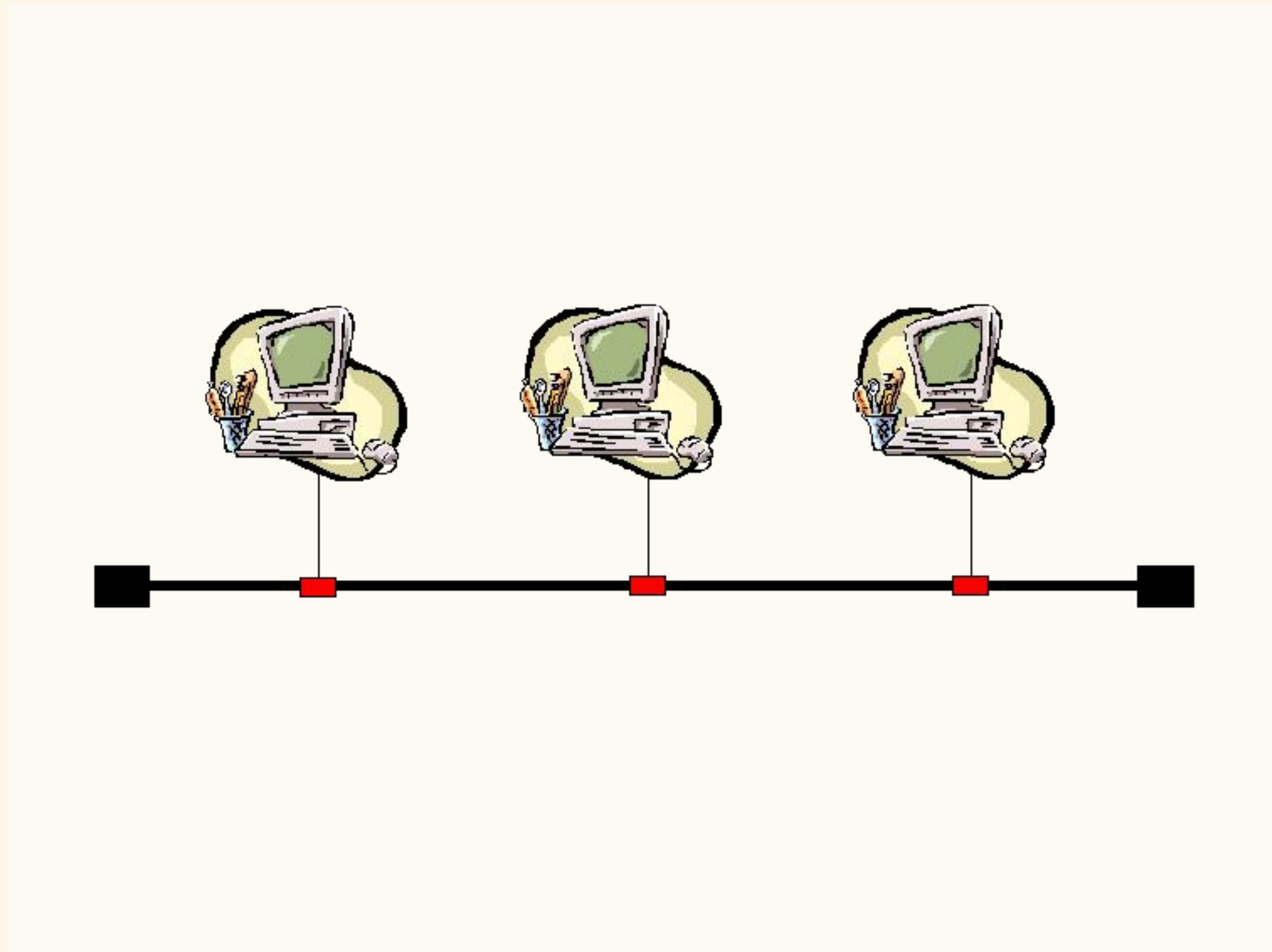
STAR TOPOLOGY



All devices are connected to a central switch or hub

Data passes through the hub/switch before reaching the destination

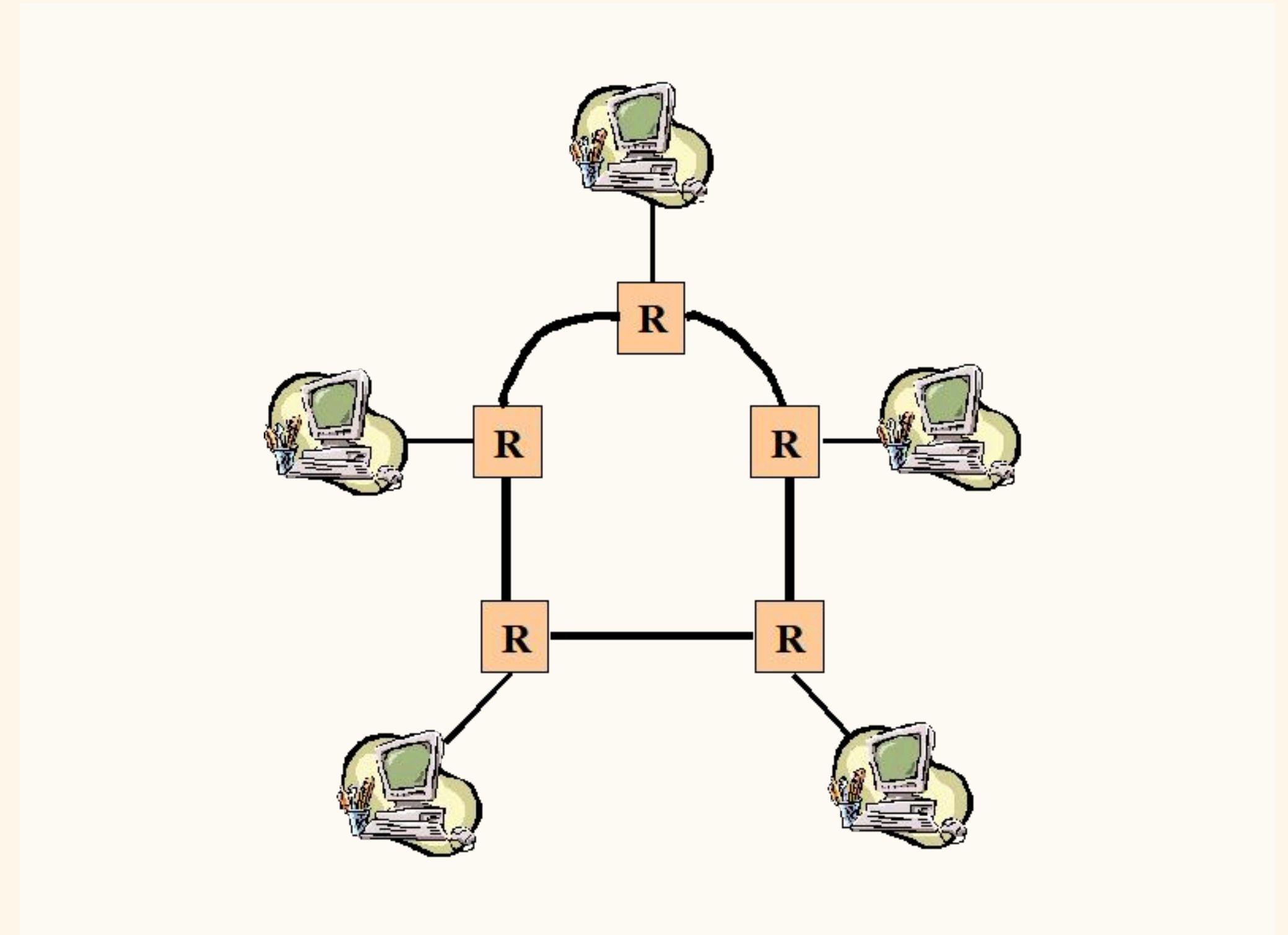
BUS TOPOLOGY



All devices are connected to a single central cable (bus).

Data travels in both directions along the bus until it reaches its destination.

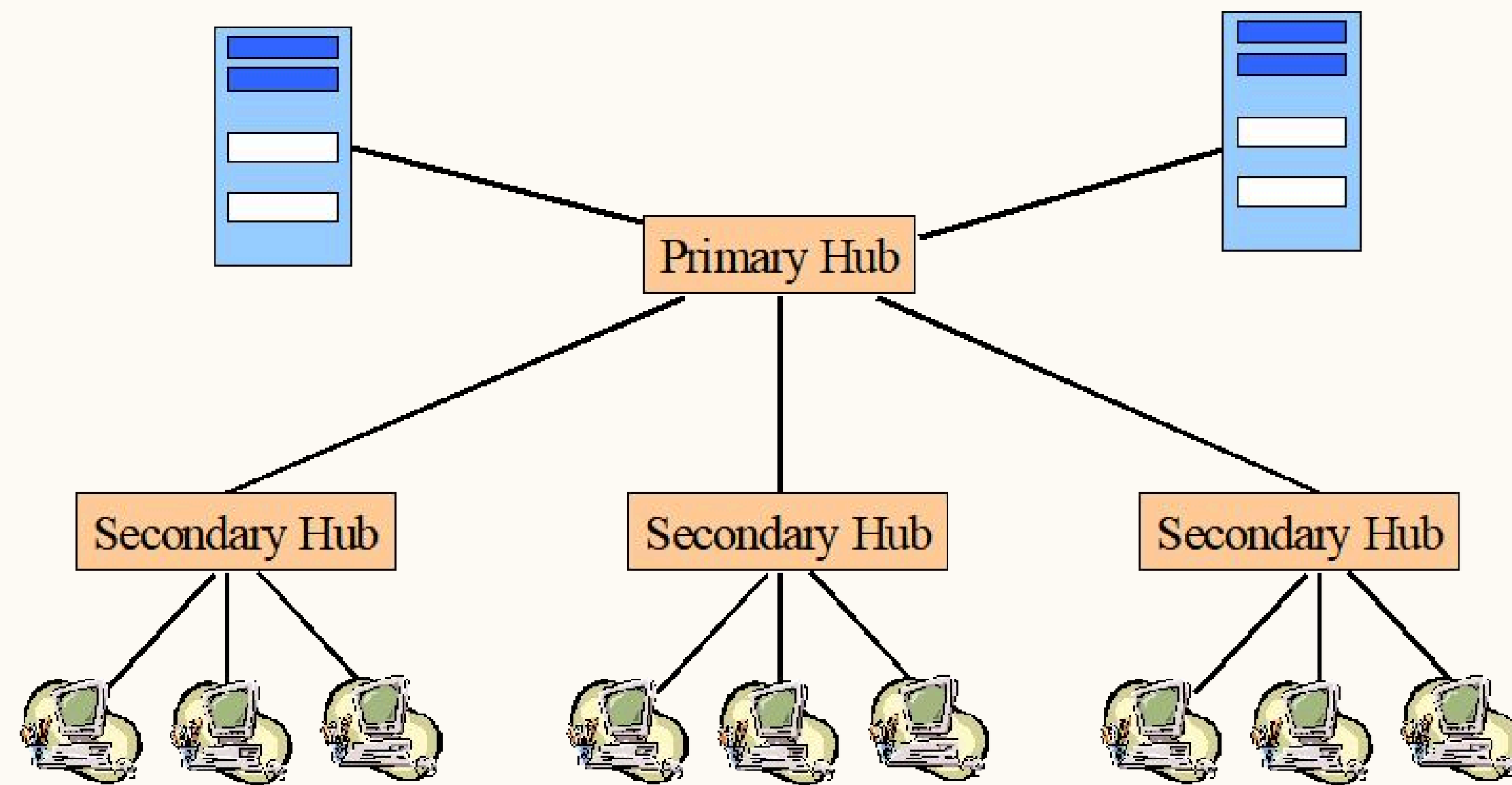
RING TOPOLOGY



Devices are connected in a circle (ring). Each device is linked to two others.

Data moves in one direction (unidirectional) or both directions (bidirectional)

TREE TOPOLOGY



A combination of star and bus topologies with a hierarchy

Devices are connected in a tree-like structure with multiple branches.

Performance comparison of each topology

Cost

ລາຄາ (ຖືກ < ແພງ)

Bus < Star < Ring < Tree < Mesh

Transmit Speed

ຄວາມໄວໃນການສົ່ງຂໍ້ມູນ (ຊ້າ < ໄວ)

Bus < Ring < Tree < Star < Mesh

Expansion and Modification

ຄວາມງ່າຍໃນການຂະຫຍາຍ ແລະ ປັບແຕ່ງ (ງ່າຍ < ຍາກ)

Star < Ring < Bus < Tree < Mesh

Fault Detection

ການກວດສອບຄວາມຜິດພາດ (ງ່າຍ < ຍາກ)

Mesh < Star < Tree < Ring < Bus

Reliable

ຄວາມໝັ້ນເຊື່ອຖື (ໜ້ອຍ < ຫຼາຍ)

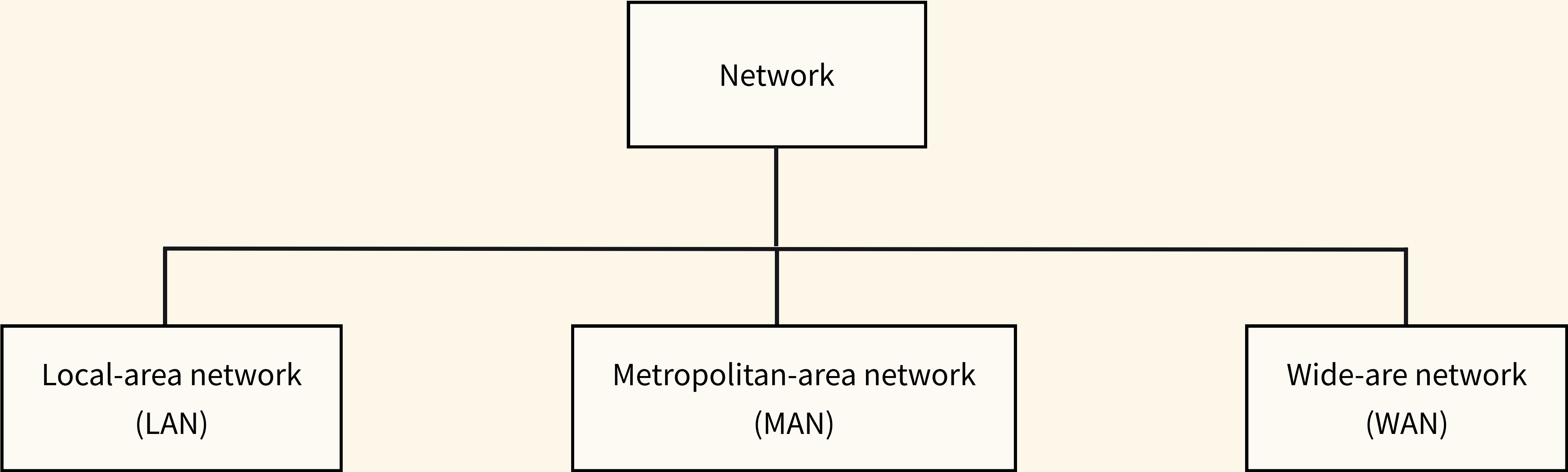
Bus < Ring < Tree < Star < Mesh

Privacy & Security

ຄວາມເປັນສ່ວນຕົວ ແລະ ຄວາມປອດໄພ (ຕໍ່າ < ສູງ)

Bus < Ring < Tree < Star < Mesh

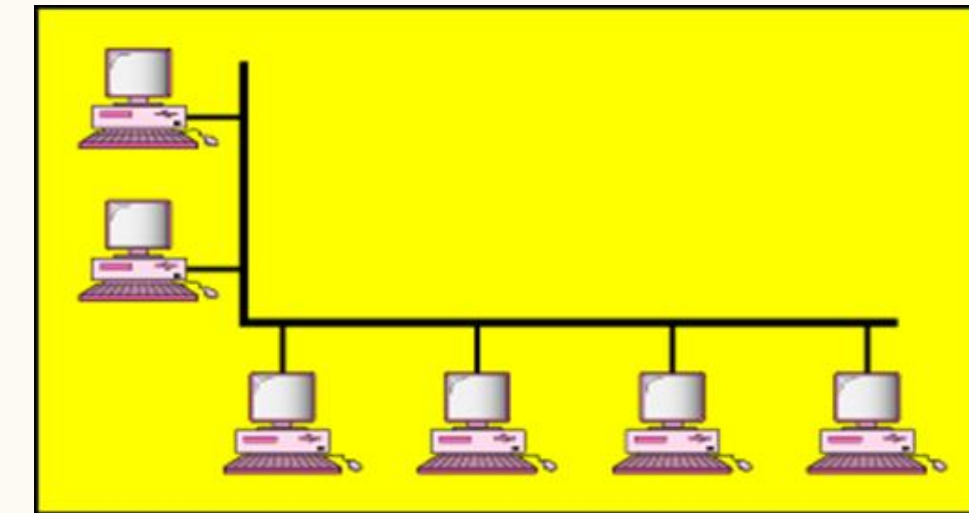
Category of Network



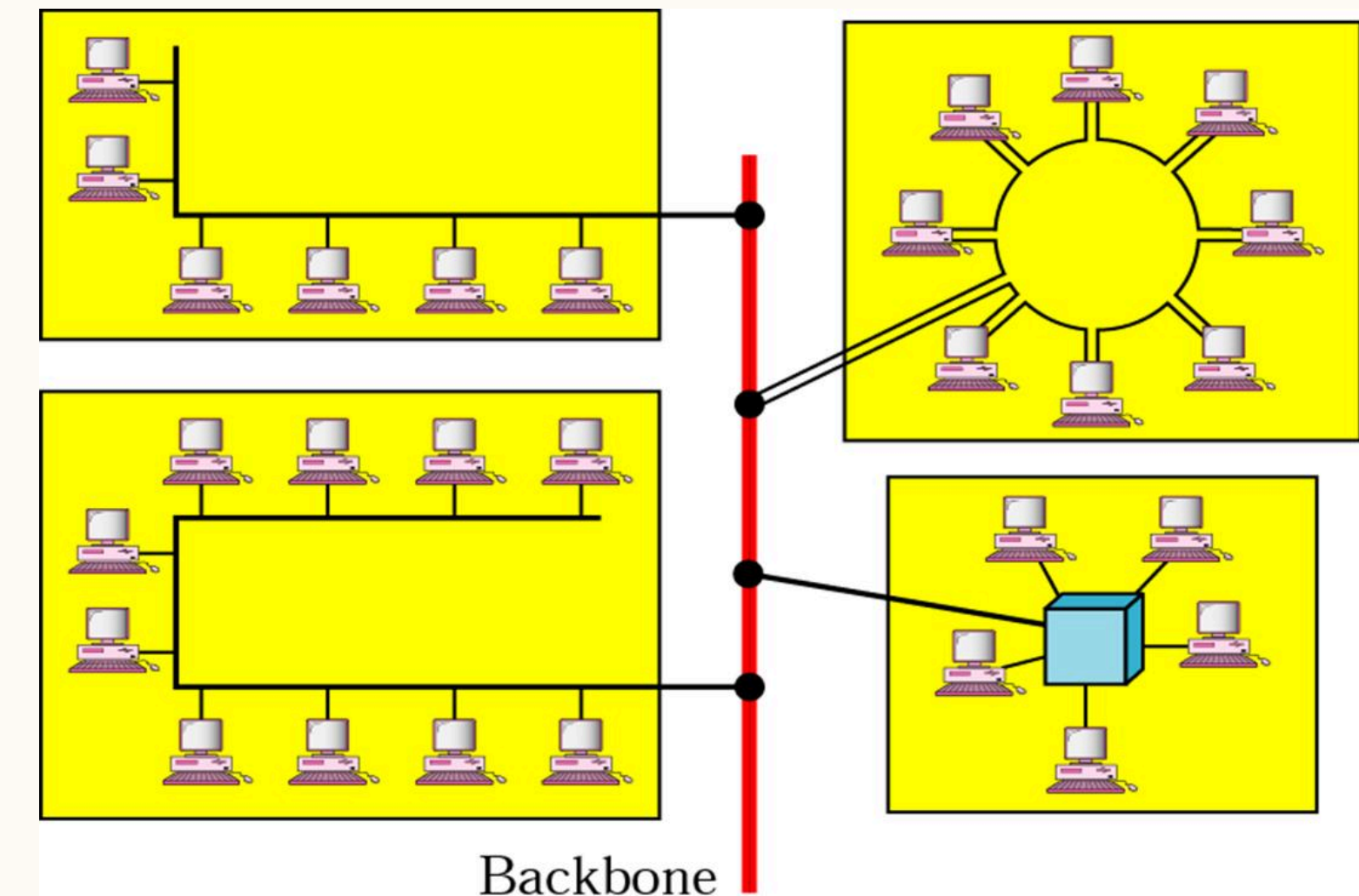
Category of Network

LAN (Local-area Network)

- Area = 2 to 3 Km
- Data rate = 100 to 1000 Mbps



a. Single-building LAN



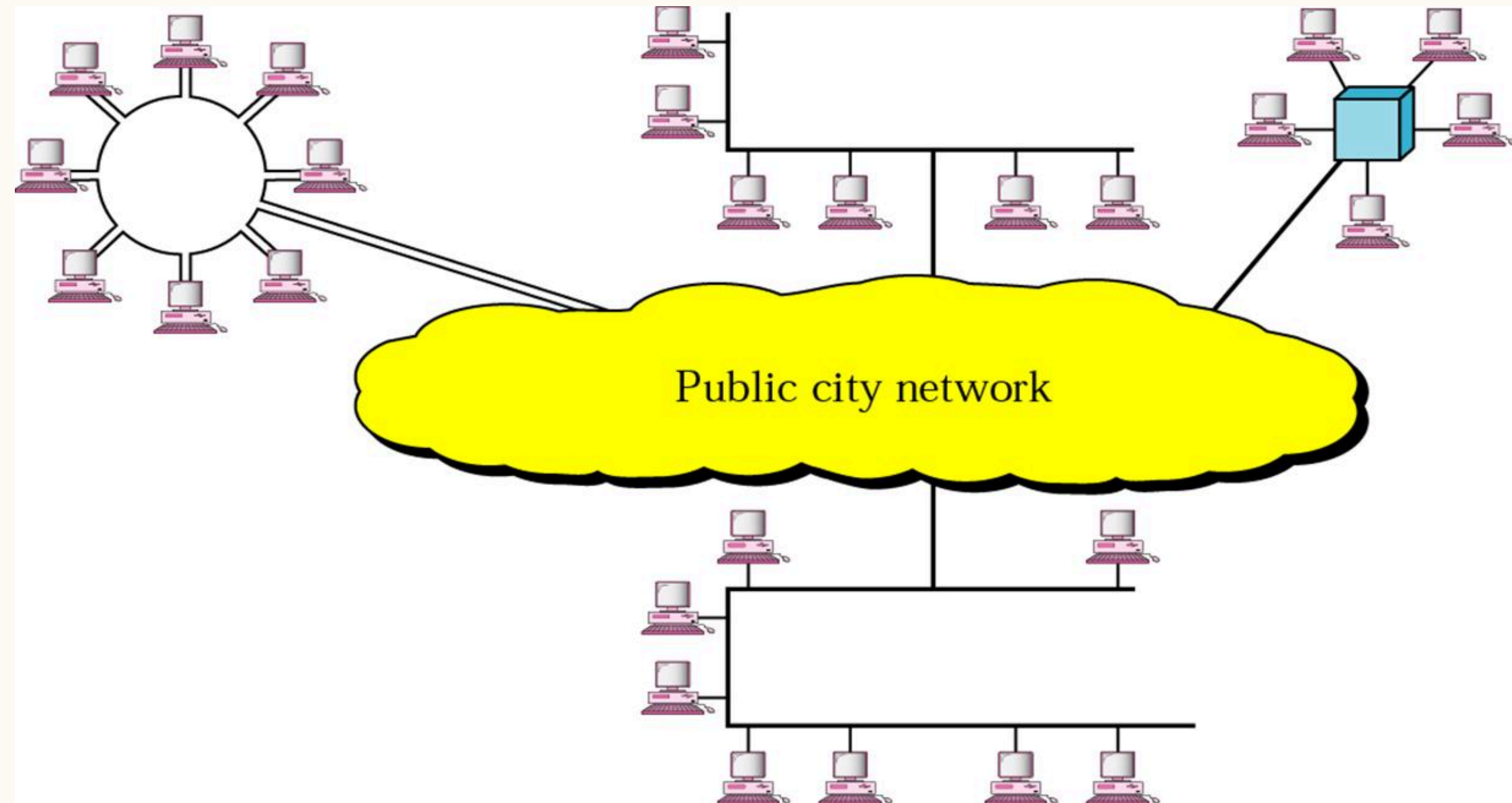
b. Multiple-building LAN

NETWORKS

Category of Network

MAN (Metropolitan-area network)

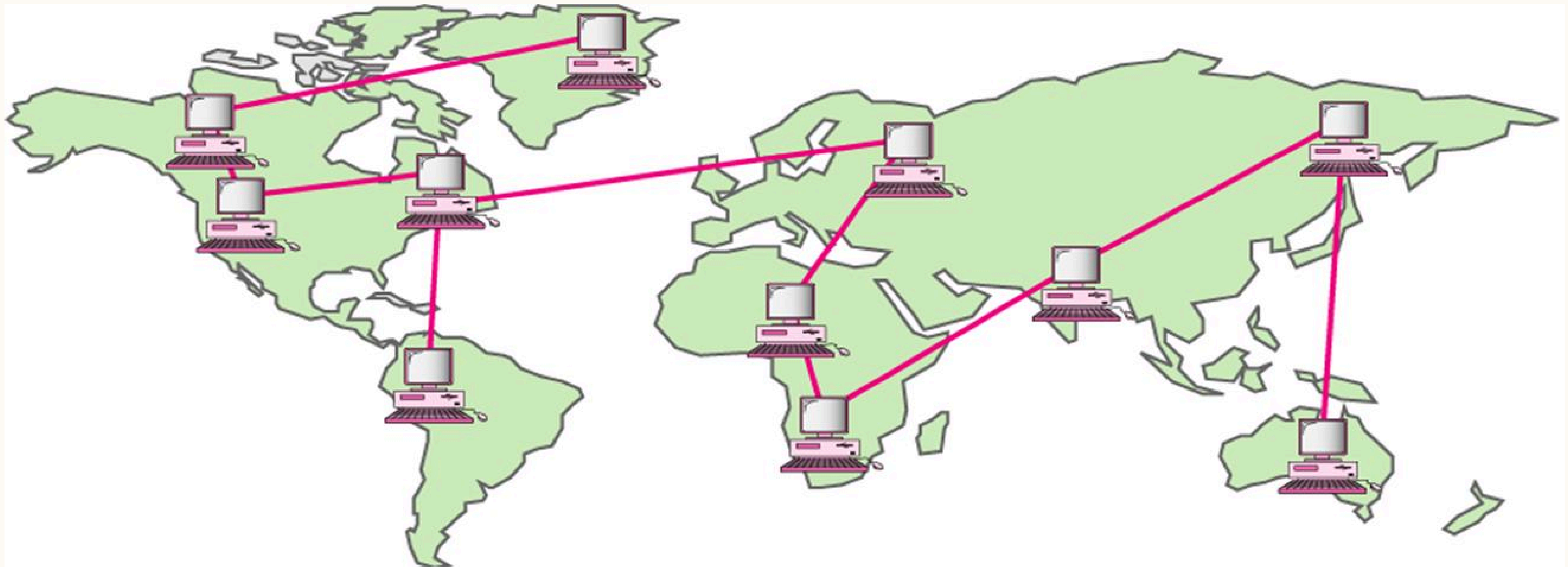
- Area = Town, city
- Part of the Telephone company Network providing



NETWORKS

Category of Network

WAN (Wide-area network)



Internet

A Brief History

The Internet Today

A Brief History

1960s - The Birth of the Internet

Advanced Research Projects Agency Network (ARPANET) was developed by the **U.S. Department of Defense**. ARPANET was the first *packet-switching network*, allowing computers at different universities to communicate

1970s - The Foundation of Modern Networking

- **1971:** The first email and the birth of @
- **1974:** The term *Internet* was first used
- **1978:** TCP/IP (Transmission Control Protocol/Internet Protocol) was developed



1980s - The Internet Goes Public

- **1983:** **ARPANET** adopted TCP/IP, officially becoming the internet.
- **1989:** World Wide Web (WWW) was used



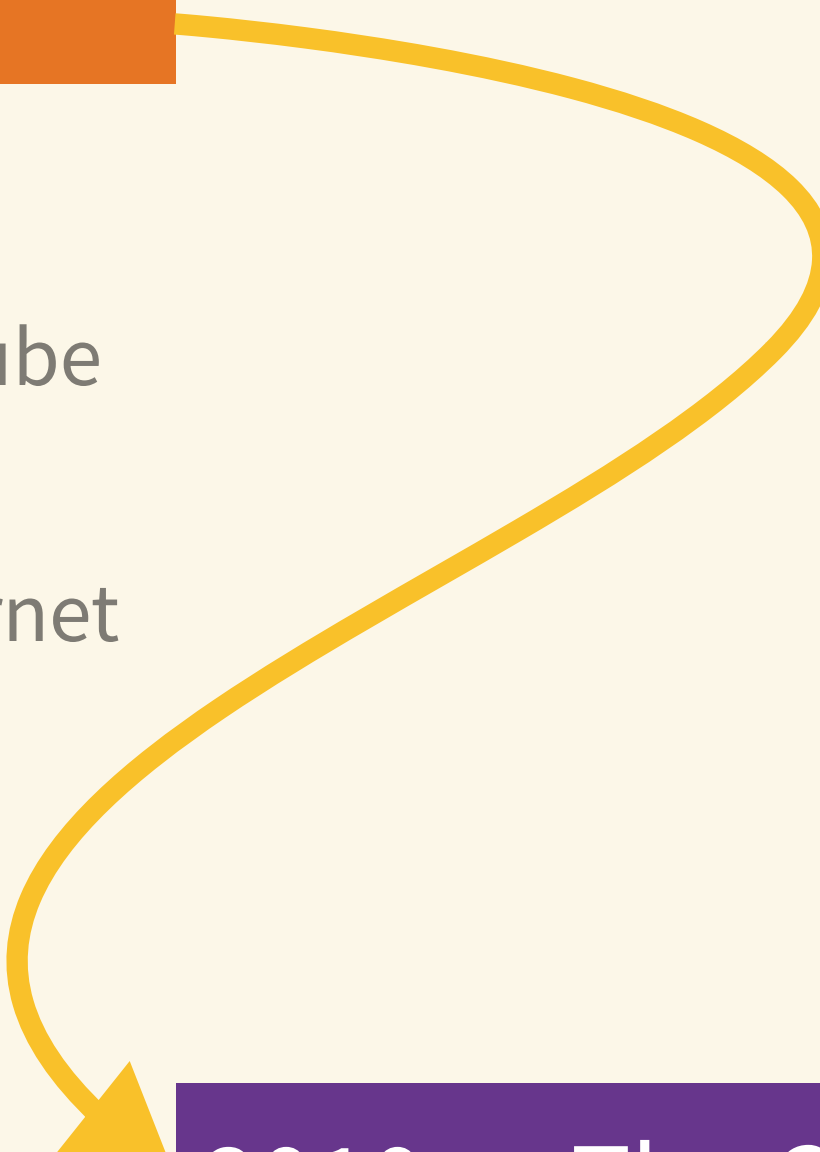
1990s – The Rise of the Web

- **1991:** The first website was created
 - **1993:** The first web browser name **Mosaic**
 - **1994:** Companies like **Amazon**, **Yahoo**, and **Netscape** were founded, leading to the **dot-com boom**.
 - **1998:** **Google** was founded
- 



2000s – The Social Media Era

- The internet became faster with **broadband**.
- Social media platforms like Facebook (2004), YouTube (2005), and Twitter (2006) emerged
- The launch of the **iPhone** (2007) made mobile internet mainstream



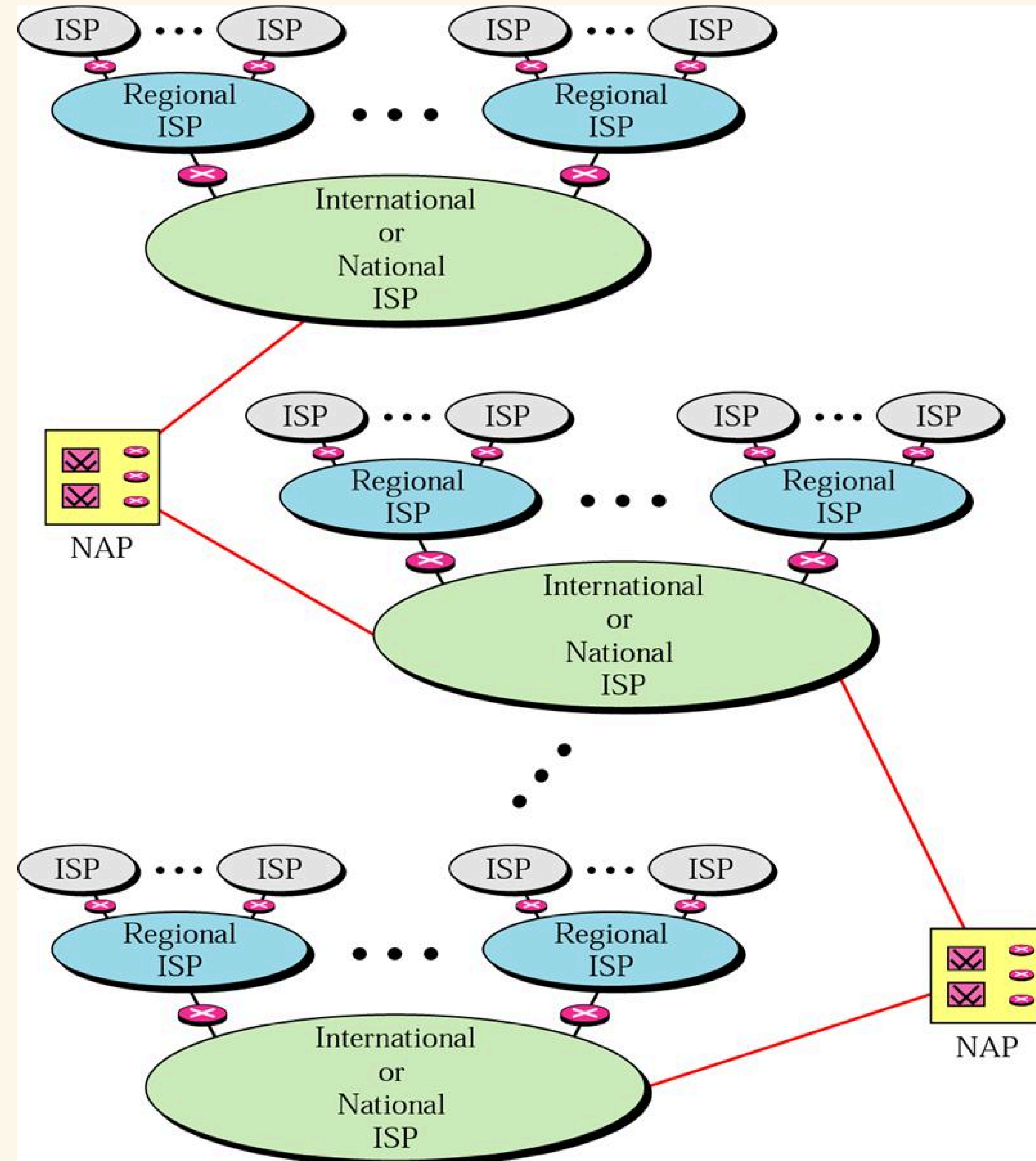
2010s – The Cloud & AI Revolution

- Cloud computing, big data, and AI-driven services (like Siri and Alexa) became mainstream
 - Streaming services (Netflix, Spotify) replaced traditional media
 - 5G networks started rolling out, improving mobile internet speeds.
- 

The Internet Today

2020s – The Future of the Internet

- **AI**, **IoT** (Internet of Things), and **blockchain** are shaping the future.
- **Metaverse** and **Web3** are emerging concepts



Criteria ໃນການວັດປະສິດທິພາບຂອງລະບົບ Network

Performance ປະສິດທິພາບໃນການສົ່ງຂໍ້ມູນ (ຄວາມໄວ)

Reliability ຄວາມໝັ້ນເຊື່ອຖື

Security ຄວາມປອດໄພ

ອົງກອນທີ່ເຮັດໜ້າທີ່ຈັດສັນມາດຕະ ຖານລະບົບສື່ສານ (Standard)

- **ISO** (International Organization for Standardization)
- **ITU** (International Telecommunication Union-Telecommunication Standards Sector)
- **ANSI** (American National Standard Institute)
- **IEEE** (Institute of Electrical and Electronics Engineers)
- **EIA** (Electronic Industries Association)
- **FCC** (Federal Communications Commission)

Q & A