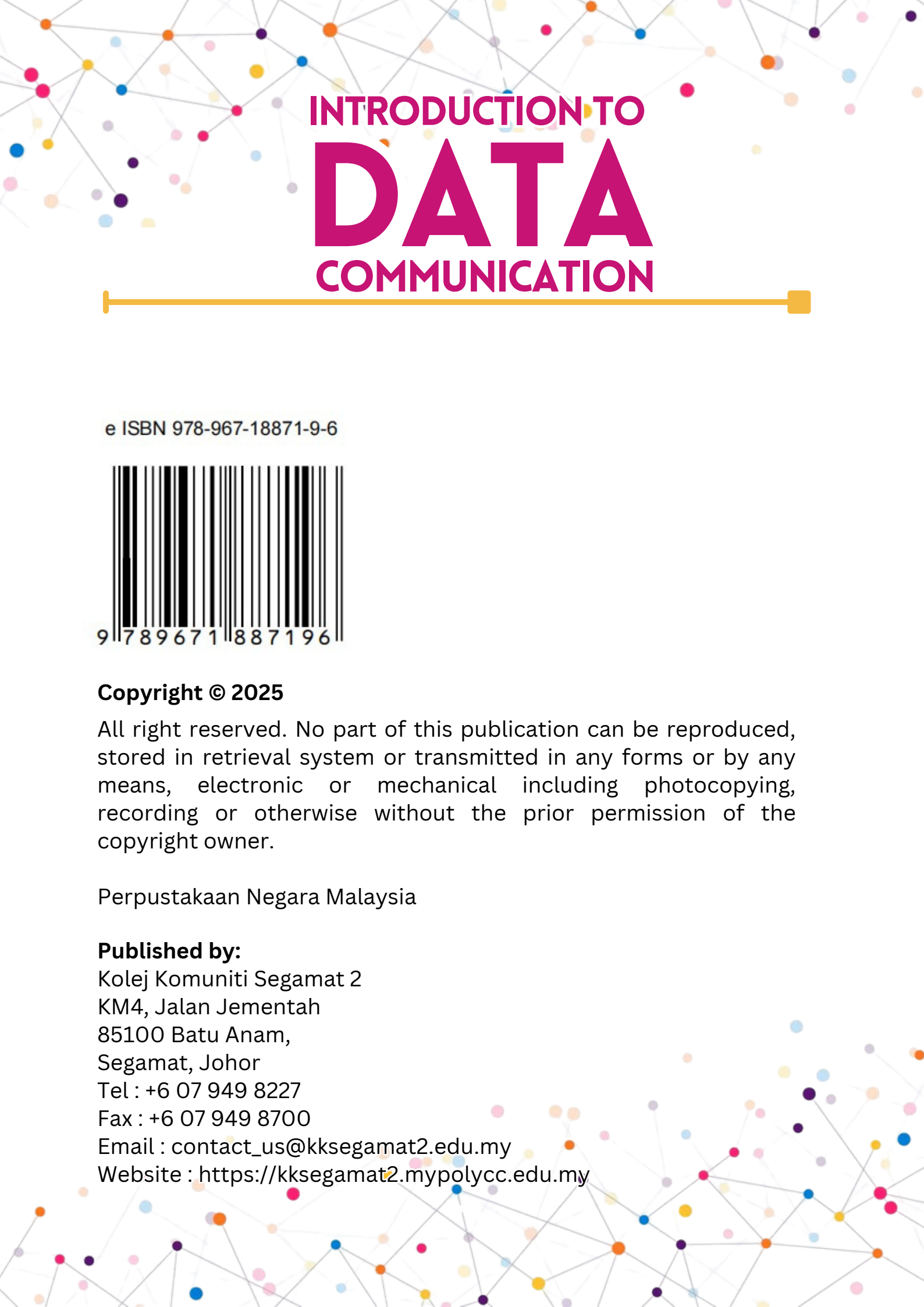


INTRODUCTION TO **DATA** COMMUNICATION

SUHAILIE BINTI DAUD
SITI NORSIAH BINTI AHMAD
TS.HASIMAHWATI BINTI ABU YAMIN
SITI NURR HIDAYAH BINTI MOHD SANIF

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INTRODUCTION TO DATA COMMUNICATION

e ISBN 978-967-18871-9-6



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Authors' Preface

Assalamualaikum w.b.t.

We are pleased to introduce this interactive Augmented Reality (AR) eBook for the course Introduction to Data Communication. This innovative learning resource is designed to support instructors and students alike by bringing complex data communication concepts to life through immersive and interactive experiences.

With the integration of AR technology, this eBook offers a dynamic and engaging platform that enhances traditional learning methods. Key topics are presented using 3D models, interactive simulations, animations, and real-time visualizations—making abstract concepts more tangible and easier to understand. Learners can explore the fundamentals of data communication anytime and anywhere, deepening their understanding through hands-on interaction.

We are sincerely grateful to all our colleagues, contributors, and collaborators who have shared their knowledge and expertise in the development of this AR eBook. Your input has been instrumental in ensuring the clarity, accuracy, and educational value of this resource. We hope that this AR eBook will inspire curiosity, promote deeper learning, and serve as a valuable tool for mastering the essentials of data communication.

Thank you for choosing our eBook. Wishing you a meaningful and enjoyable learning journey.

Sincerely,

Suhailie binti Daud

Siti Norsiah Binti Ahmad

Ts. Hasimahwati binti Abu Yamin

Siti Nurr Hidayah Binti Mohd Sanif

INTRODUCTION TO **DATA** COMMUNICATION

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USER MANUAL FOR ANDROID

Step-By-Step Guide To Use MyWebAR

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- Use your mobile browser (preferably Chrome or Safari).

STEP 2: SCAN QR CODE

- You can either type in the link or scan the QR code

STEP 3: ALLOW CAMERA ACCESS

- Allow Camera Access. Locate the Augmented Reality (AR) marker image (usually marked with an AR icon) in your e-book.

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- Hold your device steady over the Marker or Surface.
- Keep your phone static (don't shake or move too fast).
- Hold your device steady and wait a few seconds for the AR content to load.

STEP 5: WATCH THE AR CONTENT COME TO LIFE!

- Watch the AR content come to Life
- Move your device slowly around to see it from different angles.
- If there is interactive content (e.g., tap-to-play), try engaging with it.

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Staying steady helps the AR object to load accurately and stay in place.



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1



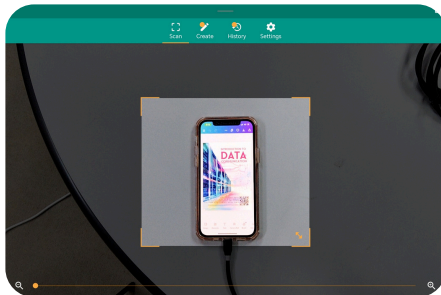
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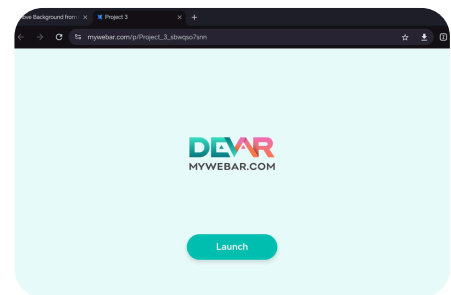
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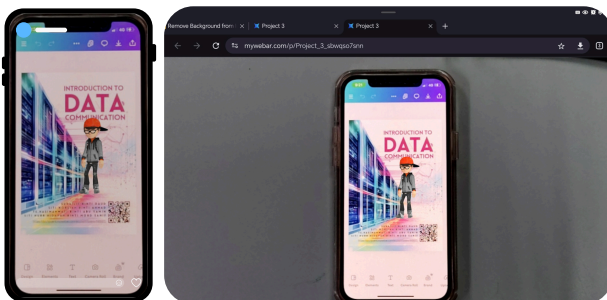
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- Click "Launch". Hold your device steady over the Marker or Surface. Keep your phone static (don't shake or move too fast). Hold your device steady and wait a few seconds for the AR content to load.

5



- Watch the AR content come to Life
- Move your device slowly around to see it from different angles.
- If there is interactive content (e.g., tap-to-play), try engaging with it.

! This is important:
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BASICS OF COMMUNICATIONS

1.1 INTRODUCTION TO DATA COMMUNICATIONS

Data communications is a vital field that encompasses the transfer of data between devices through various transmission mediums.

This document provides an overview of the fundamental concepts, components, and protocols that govern data communication systems. Understanding these principles is essential for anyone looking to delve into the world of networking, telecommunications, and information technology.

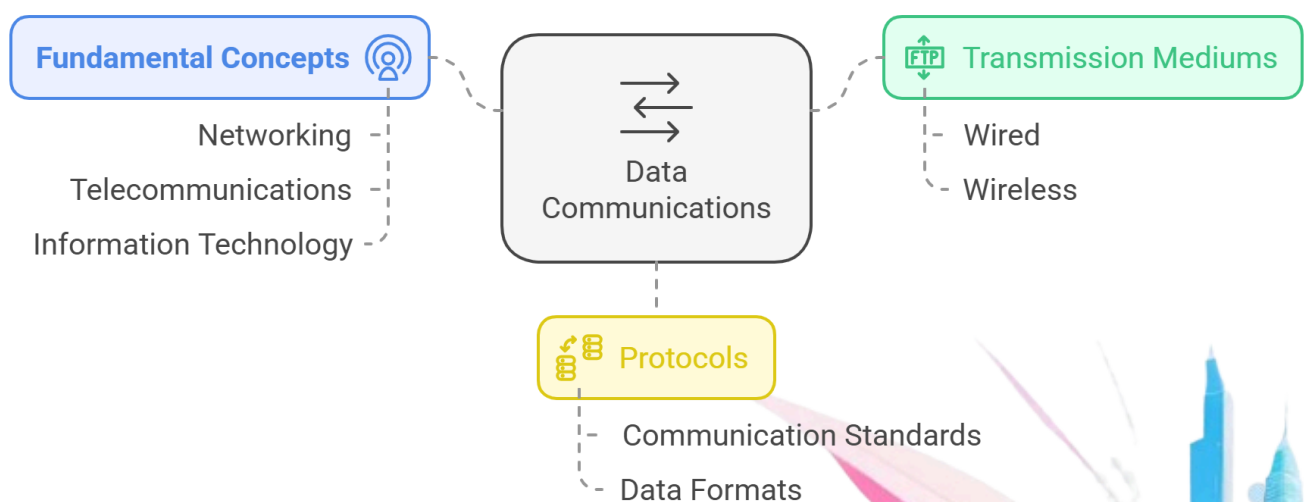


Figure 1.1: Data Communications: Concepts, Components, and Protocols



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1.2 WHAT IS DATA COMMUNICATION ?

Data communication refers to the exchange of data between devices using a transmission medium. This can include wired connections, such as Ethernet cables, or wireless connections, such as Wi-Fi and cellular networks. The primary goal of data communication is to ensure that data is transmitted accurately and efficiently from one point to another.

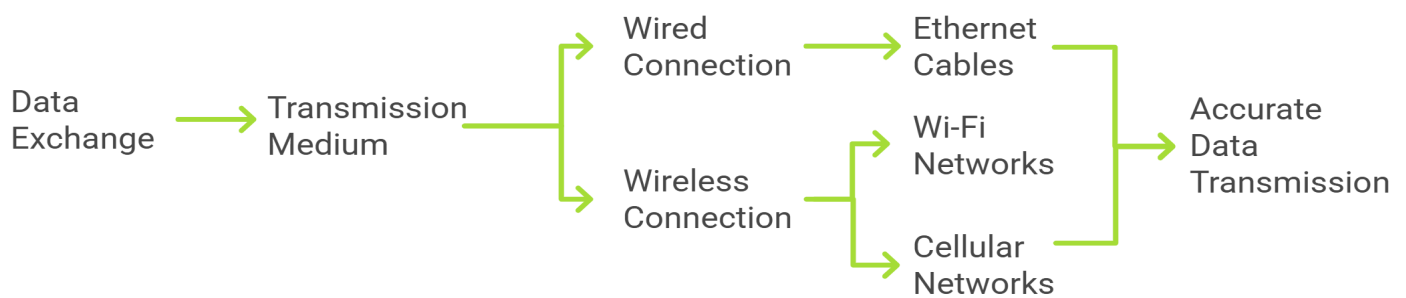


Figure 1.2: Data Communication Process

ASSESSMENT

1.2 What is Data Communication?

Scan the QR to answer the question



1.3 KEY COMPONENTS OF DATA COMMUNICATION?

Sender:

- The device that initiates the communication by sending data.

Receiver:

- The device that receives the data sent by the sender.

Transmission Medium:

- The physical path through which the data travels. This can be guided (like cables) or unguided (like radio waves).

Message:

- The actual data that is being communicated.

Protocol:

- A set of rules that govern the communication process, ensuring that devices can understand each other.

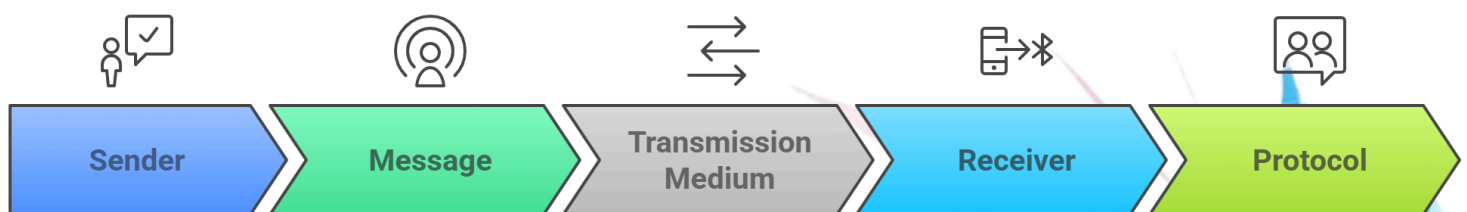
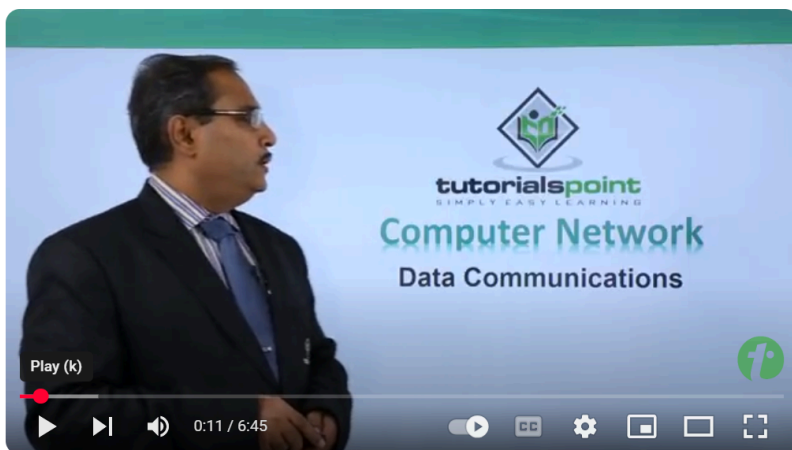


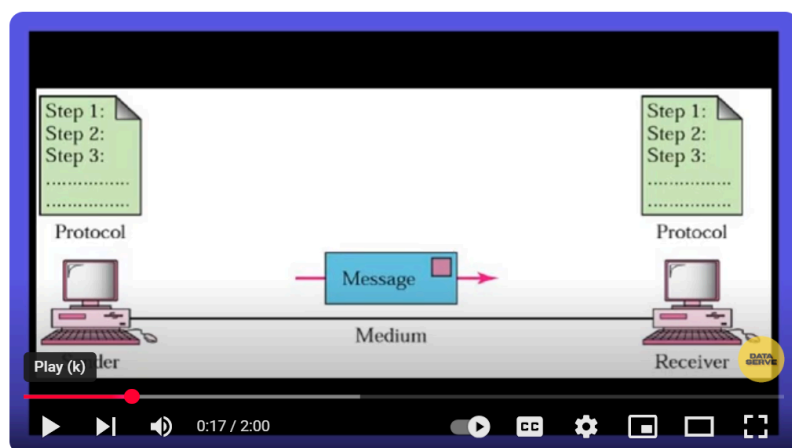
Figure 1.3: Components of Data Communication

**Click on links or scan QR codes to view more info on
Data Communication.**



Data Communications

<https://www.youtube.com/watch?v=ULgKbLWhgEM&t=138s>



Components of data communication

<https://www.youtube.com/watch?v=579tFNgl0gw>

1.3.1 SENDER

The sender is the device or entity that initiates the communication by transmitting data. This could be a computer, smartphone, or any other device capable of sending information.

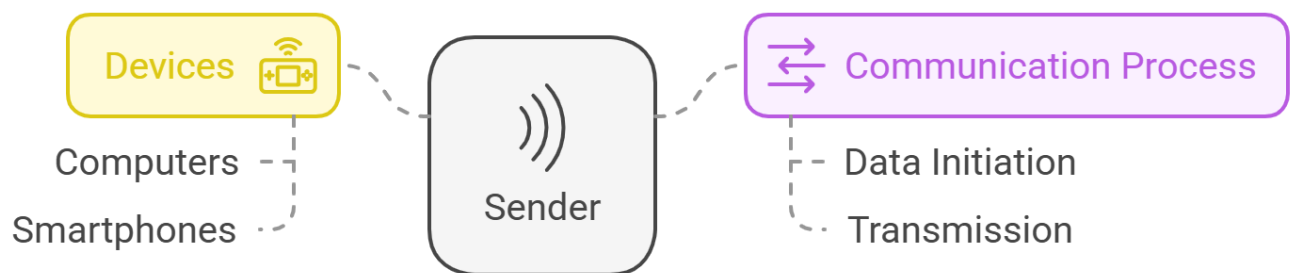


Figure 1.4: Role of the sender in Data Communication



1.3.2 MESSAGE

The message is the actual data that is being communicated. It can be in various forms, such as text, audio, video, or any other type of digital information.



Figure 1.5: Understanding Diverse Forms of Messages in Data Communication

1.3.3 TRANSMISSION MEDIUM

The medium is the physical path or channel through which the message travels from sender to receiver. This can include wired mediums like cables (e.g., coaxial, fiber optic) or wireless mediums like radio waves, microwaves, or infrared signals.

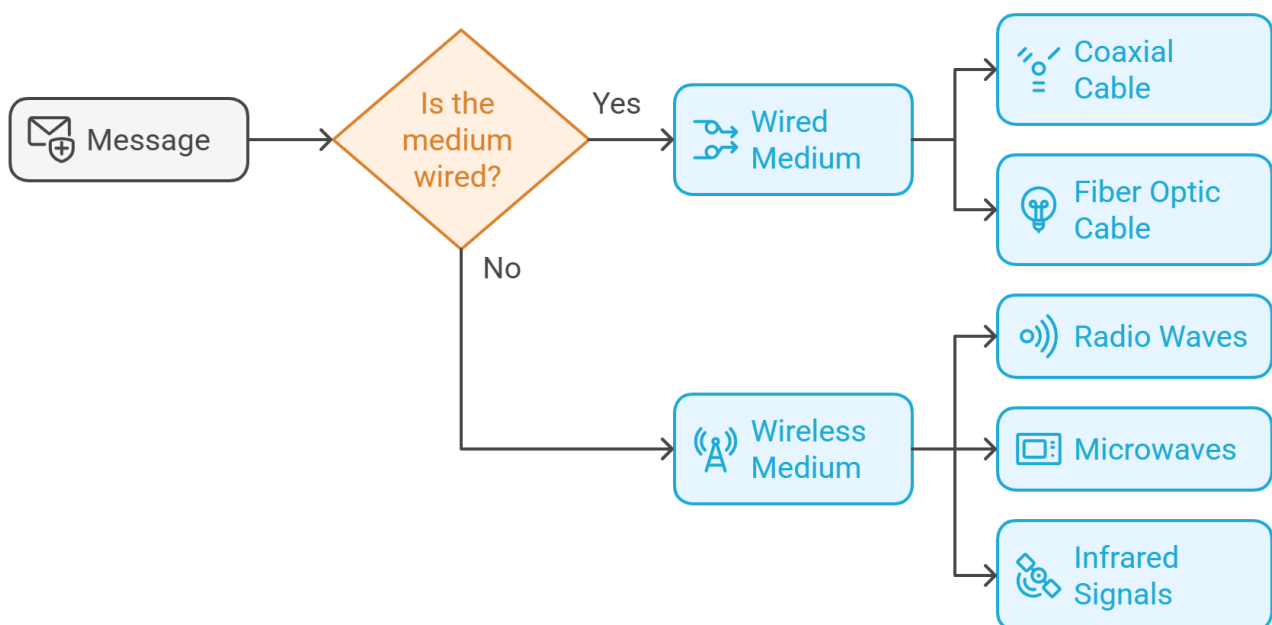


Figure 1.6: Data Communication Medium Selection

1.3.4 RECEIVER

The receiver is the device or entity that receives the transmitted data. Similar to the sender, it can be any device capable of interpreting the incoming information.



Sender

Initiates data transmission



Receiver

Interprets incoming data

Figure 1.7: Differences Between Sender and Receiver

1.3.5 PROTOCOL

Protocols are the rules and conventions that govern the communication process. They define how data is formatted, transmitted, and received, ensuring that both the sender and receiver understand the information being exchanged. Examples include TCP/IP, HTTP, and FTP.

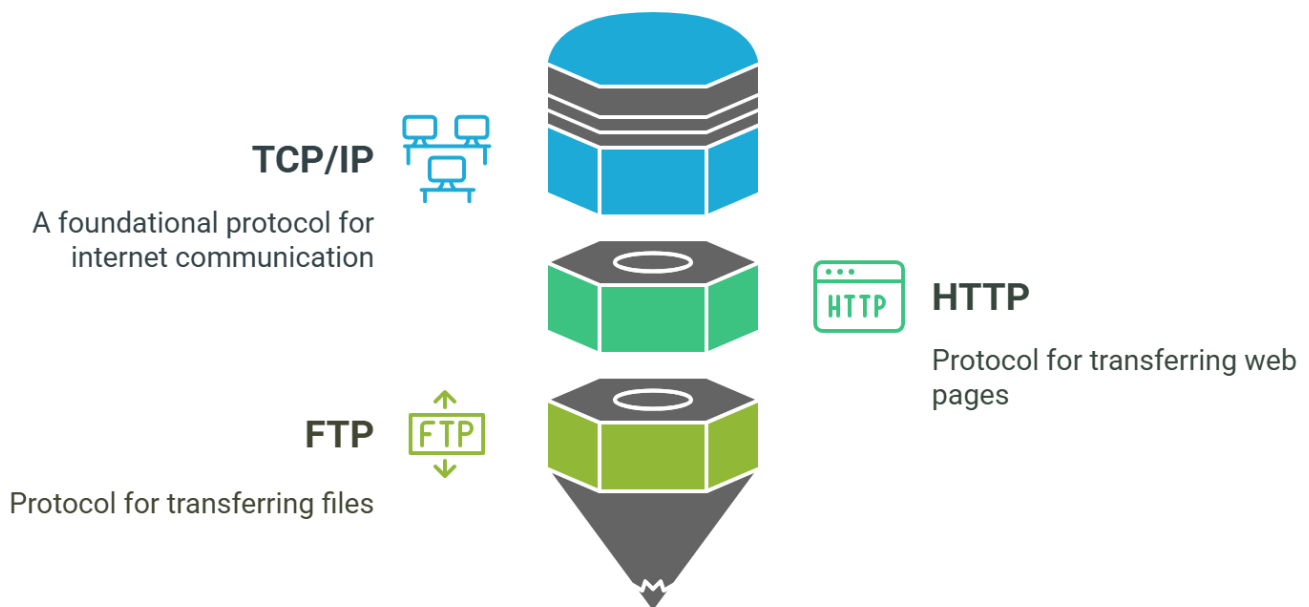


Figure 1.8: Communication Protocols

ASSESSMENT

1.3 Key Components of Data Communication

Scan the QR to answer the questions



1.4 TRANSMISSION MODES IN COMPUTER NETWORKS

Transmission modes in computer networks are used to transfer data between the connected devices. In a network, devices can communicate with each other through transmission modes.

Transmission modes are used to direct the direction of the flow of information and are also called communication modes.

Types of Transmission Modes

There are three types of transmission modes in computer networks as follows:

- Simplex Communication Mode
- Half-duplex Communication Mode
- Full-duplex Communication Mode

<https://digitalnoteshub.com/transmission-modes-in-computer-networks/>



1.4.1 SIMPLEX

In simplex communication mode, the information is communicated in only one direction. There is only one transmitter and one receiver, hence the system is unidirectional. The following are examples of simplex communication mode.

- Keyboard and Traditional Monitors.
- Radio Systems.



Figure 1.9: Simplex Transmission: Characteristics and Applications

These devices can only transmit the data and cannot receive it. The following diagram shows the simplex communication mode between two connected devices A and B.

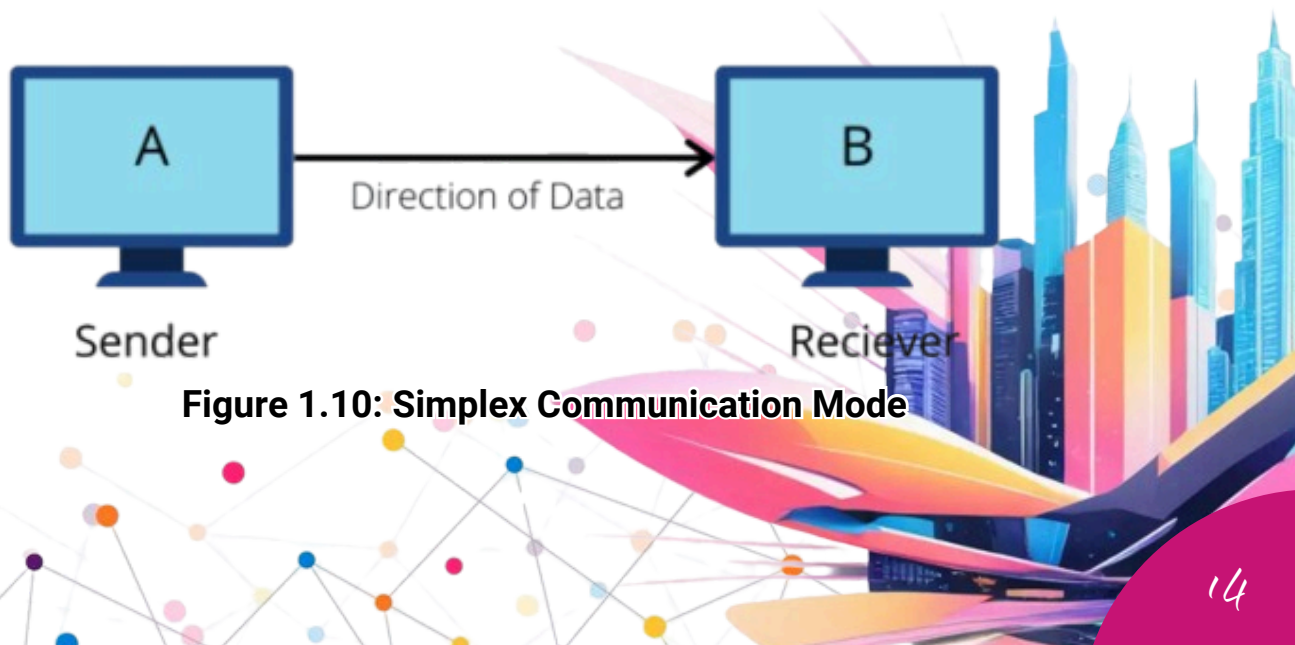


Figure 1.10: Simplex Communication Mode

1.4.2 HALF-DUPLEX

In half-duplex mode, the data flow is bidirectional, but not at the same time. It means both connected devices can transmit and receive data, but not simultaneously. At a time, the device can work either as a transmitter or receiver.

The examples are transceiver and walkie-talkie set.

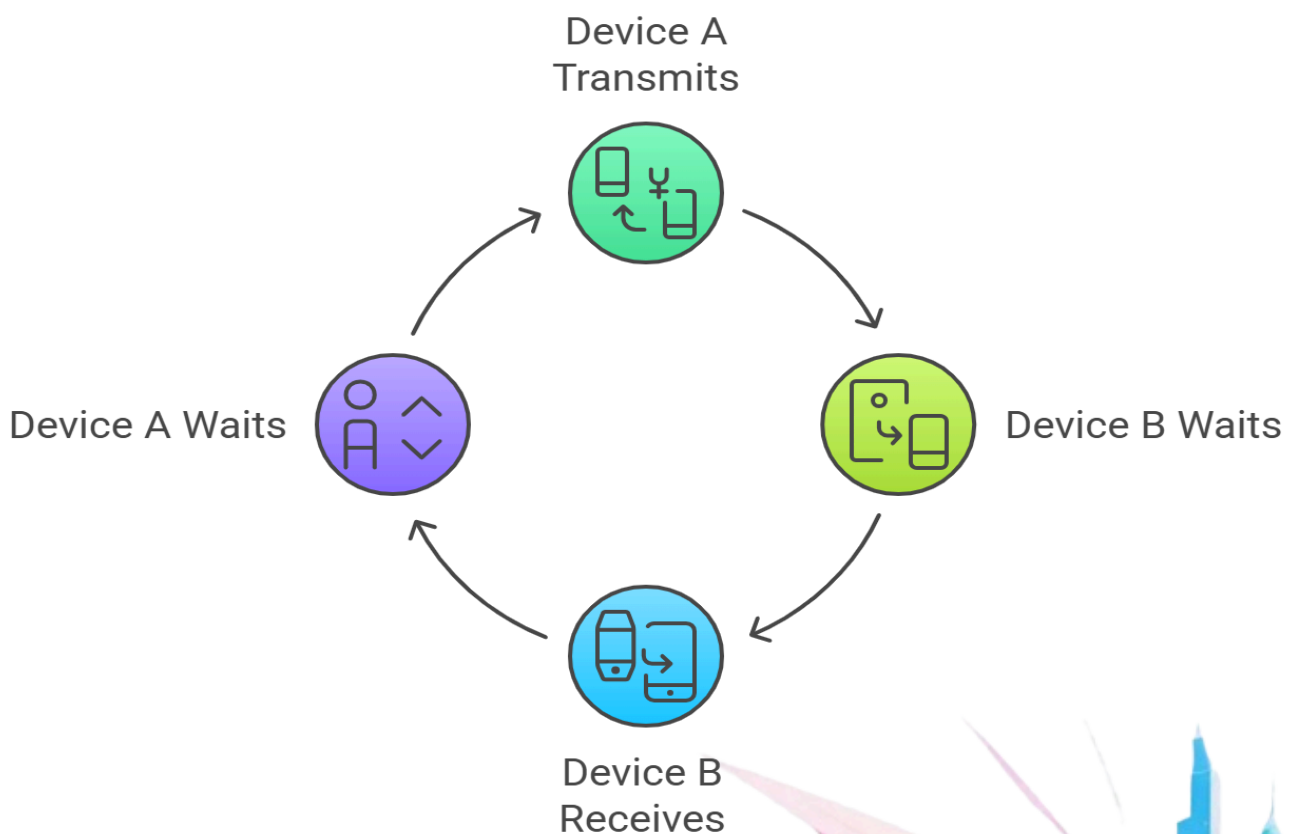
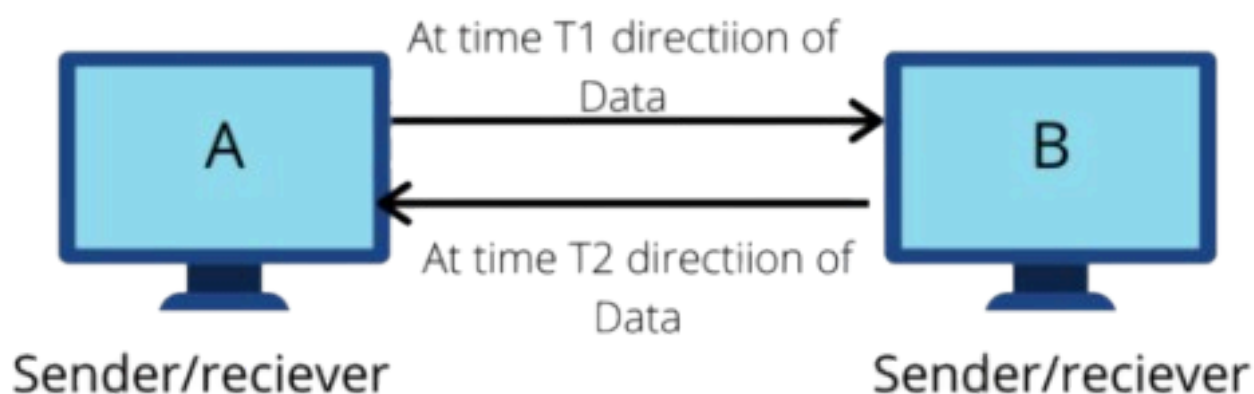


Figure 1.11: Half-Duplex Communication Cycle

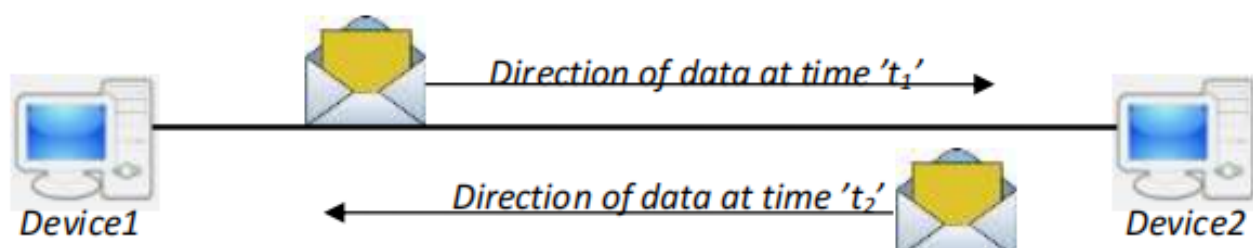
The following diagram shows a half-duplex mode between A and B. At a time T1, A works as a transmitter and B as a receiver. At time T2, A works as receiver and B as a transmitter.

Hence the At time T1 data flows from A to B and at time T2 data flow from B to A.



Sample 1: Half-Duplex Communication Mode

<https://digitalnoteshub.com/transmission-modes-in-computer-networks/>



Sample 2: Half-Duplex Communication Mode

[https://www.tvu.edu.in/wp-content/uploads/2020/01/DCN_Notes_Final%20\(1\)_compressed.pdf](https://www.tvu.edu.in/wp-content/uploads/2020/01/DCN_Notes_Final%20(1)_compressed.pdf)

1.4.3 FULL-DUPLEX

In full-duplex mode, the data flow is bidirectional. It means both connected devices can transmit and receive data simultaneously. The devices can send or receive data at the same time.

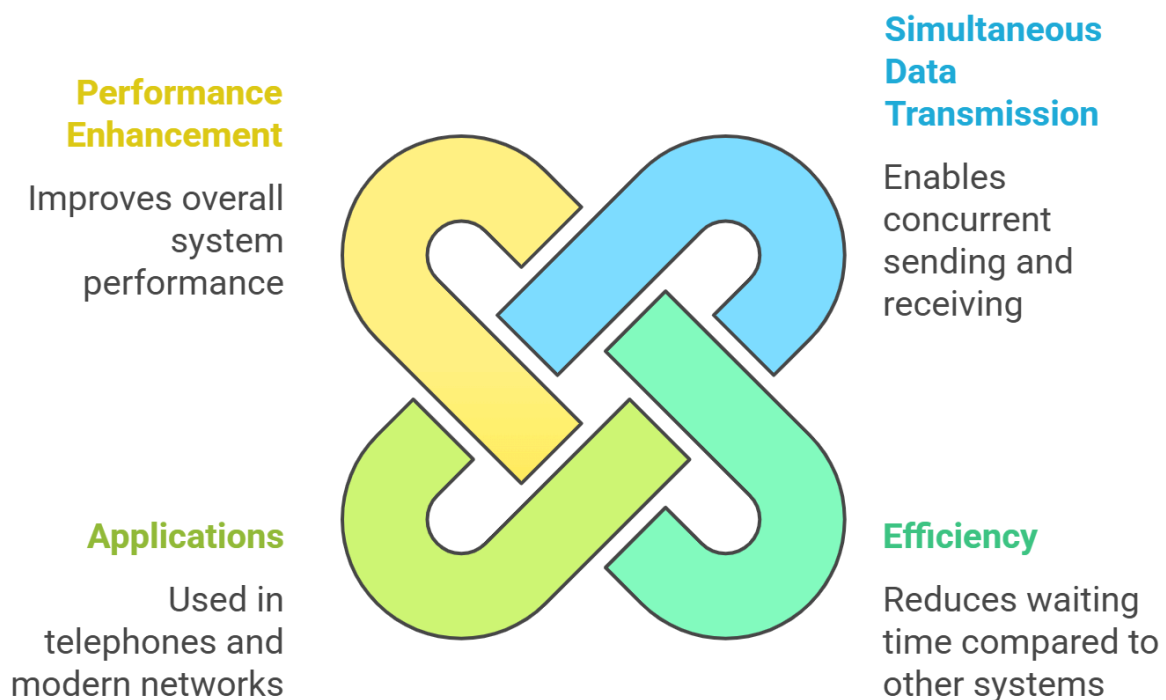
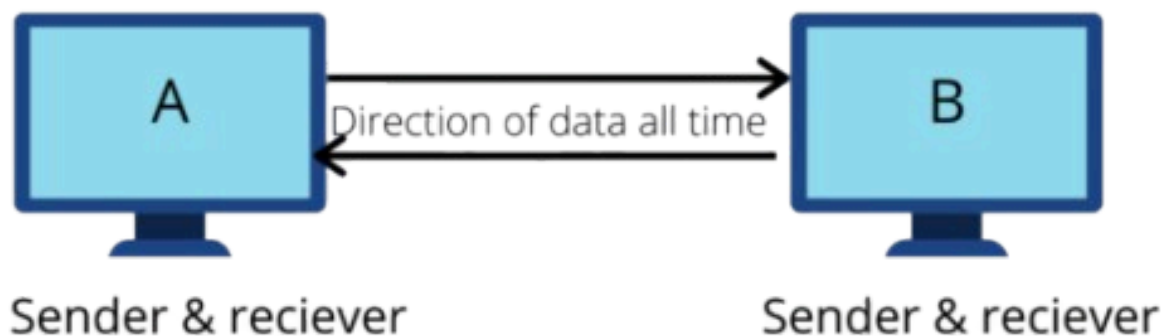


Figure 1.12 : Full-Duplex Communication

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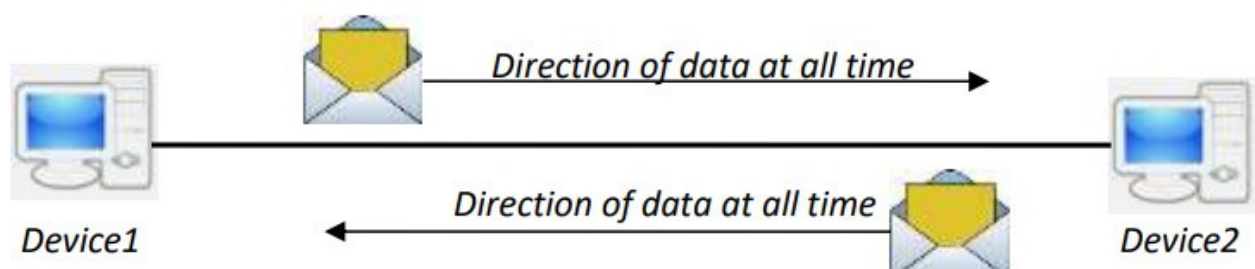
An example of a full-duplex mode is the telephone system.

The following diagram shows full-duplex communication between A and B. A and B both work as sender or receiver. And data flow is also from both directions.



Sample 3: Full-Duplex Communication Mode

<https://digitalnoteshub.com/transmission-modes-in-computer-networks/>



Sample 4: Full-Duplex Communication Mode

[https://www.tvu.edu.in/wp-content/uploads/2020/01/DCN_Notes_Final%20\(1\)_compressed.pdf](https://www.tvu.edu.in/wp-content/uploads/2020/01/DCN_Notes_Final%20(1)_compressed.pdf)

1.4.4 DIFFERENCES BETWEEN SIMPLEX, HALF DUPLEX AND FULL DUPLEX COMMUNICATION MODE

SIMPLEX	HALF-DUPLEX	FULL-DUPLEX
The direction of data is only in one direction.	The direction of data is bidirectional, but not at the same time.	The direction of data is bidirectional at the same time
The sender can send the data but cannot receive the data.	The system can send or receive the data, but not at one time.	The system can send or receive the data simultaneously.
It provides less performance than the other two modes.	It provides a high performance than the simplex mode.	It provides a high performance than the other two modes.
For example, Traditional keyboard and Monitor.	For example- walky-talky	For example- Telephone

Table 1.1: Differences Between Simplex, Half duplex and Full duplex Communication Mode

ASSESSMENT

1.4 Transmission Modes

Scan the QR to answer the questions



1.5 DEFINE TELECOMMUNICATION TECHNOLOGY AND ITS ADVANTAGES

Telecommunication technology refers to the various systems and methods used to transmit information over distances for the purpose of communication. This encompasses a wide range of technologies, including telephones, radio, television, satellite communications, and the internet. The evolution of telecommunication technology has transformed how individuals and businesses connect, share information, and conduct transactions, leading to significant advancements in various sectors.

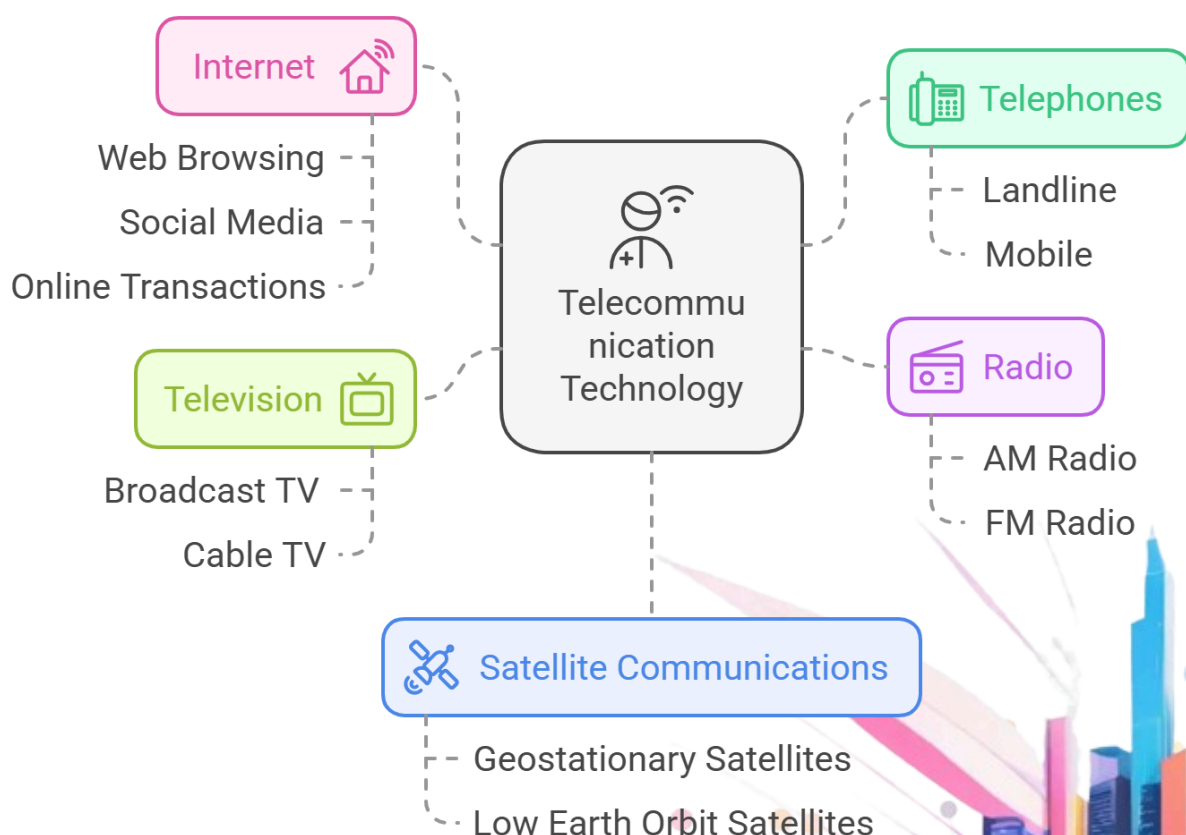


Figure 1.13: Telecommunication Technology: Systems, Methods & Impact

1.5.1 ADVANTAGES OF TELECOMMUNICATION TECHNOLOGY

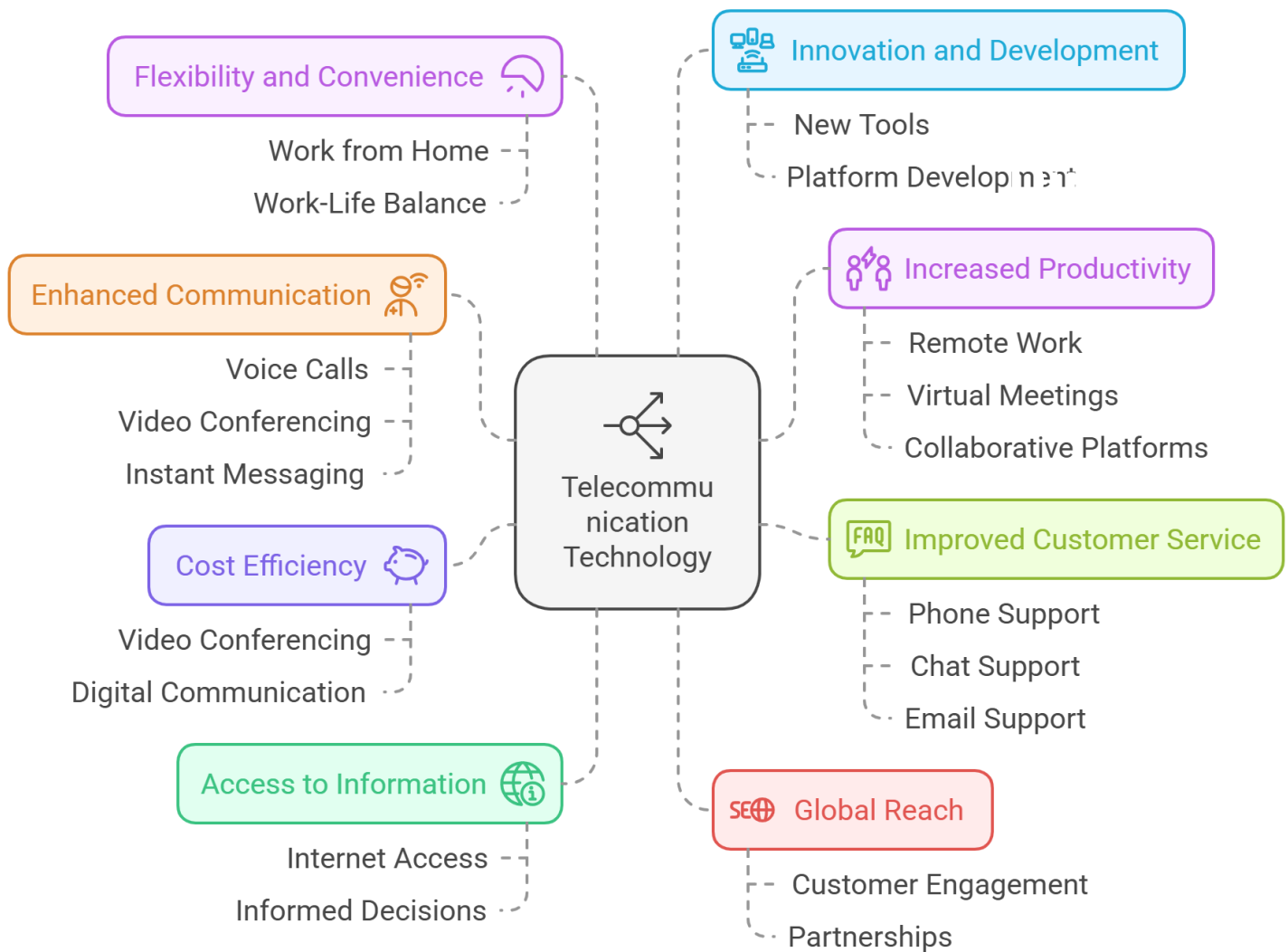


Figure 1.14: Benefits of Telecommunication Technology

ASSESSMENT

1.5 Telecommunication Technology

Scan the QR to answer the questions



1.6 IDENTIFY TYPES OF TELECOMMUNICATION TECHNOLOGIES

There are various telecommunications technologies that have formed the modern communication system. Each technology plays a crucial role in enhancing connectivity, data transmission, and overall user experience in mobile and wireless communications. Below, we explore several key technologies, including GSM, GPRS, EDGE, HSPDA, WiMAX, and LTE.



Figure 1.15: Telecommunications Technologies Overview

ASSESSMENT

1.6 Types of Telecommunication Technologies

Scan the QR to answer the questions



1.7 TYPES OF NETWORK DEVICES

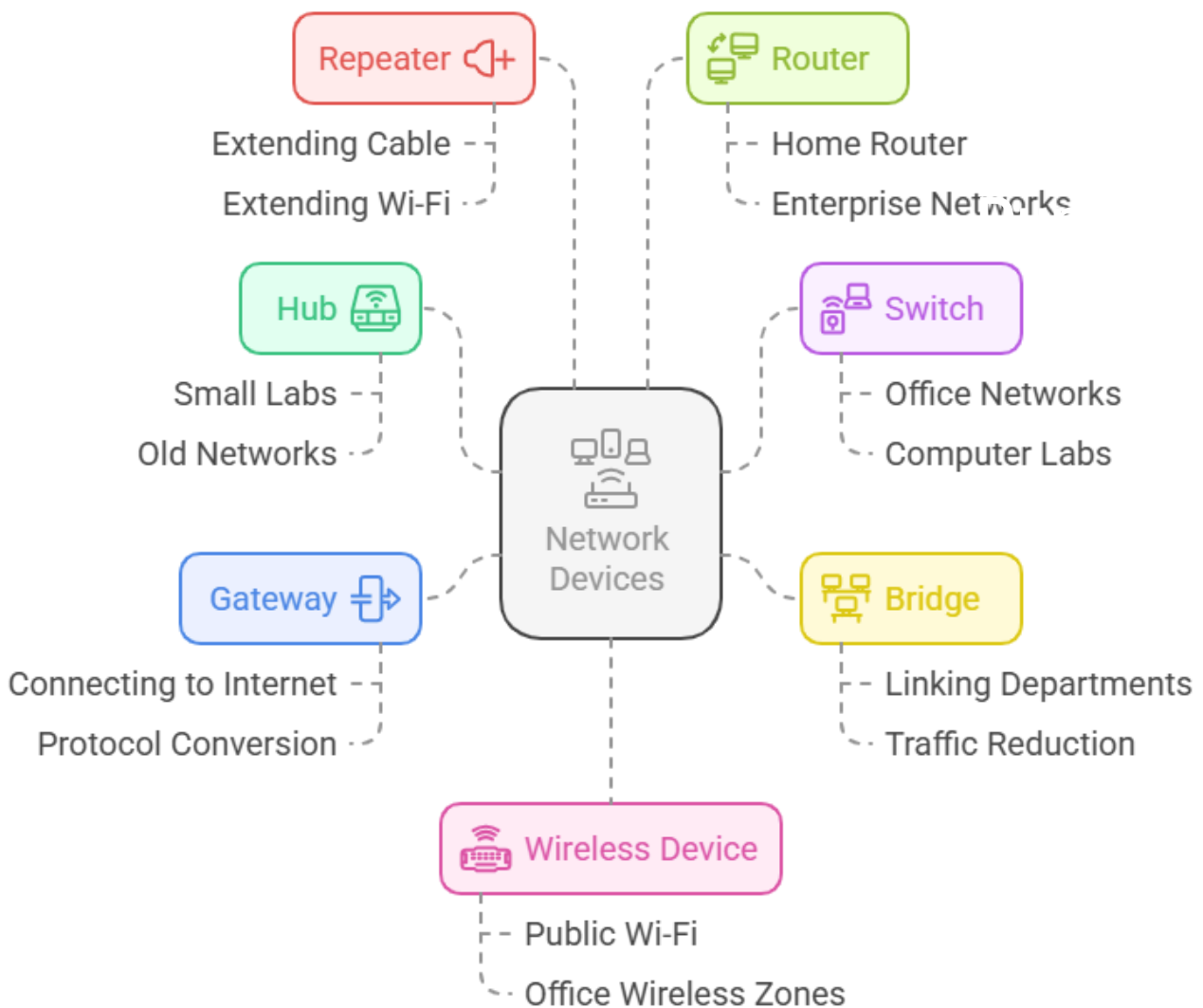
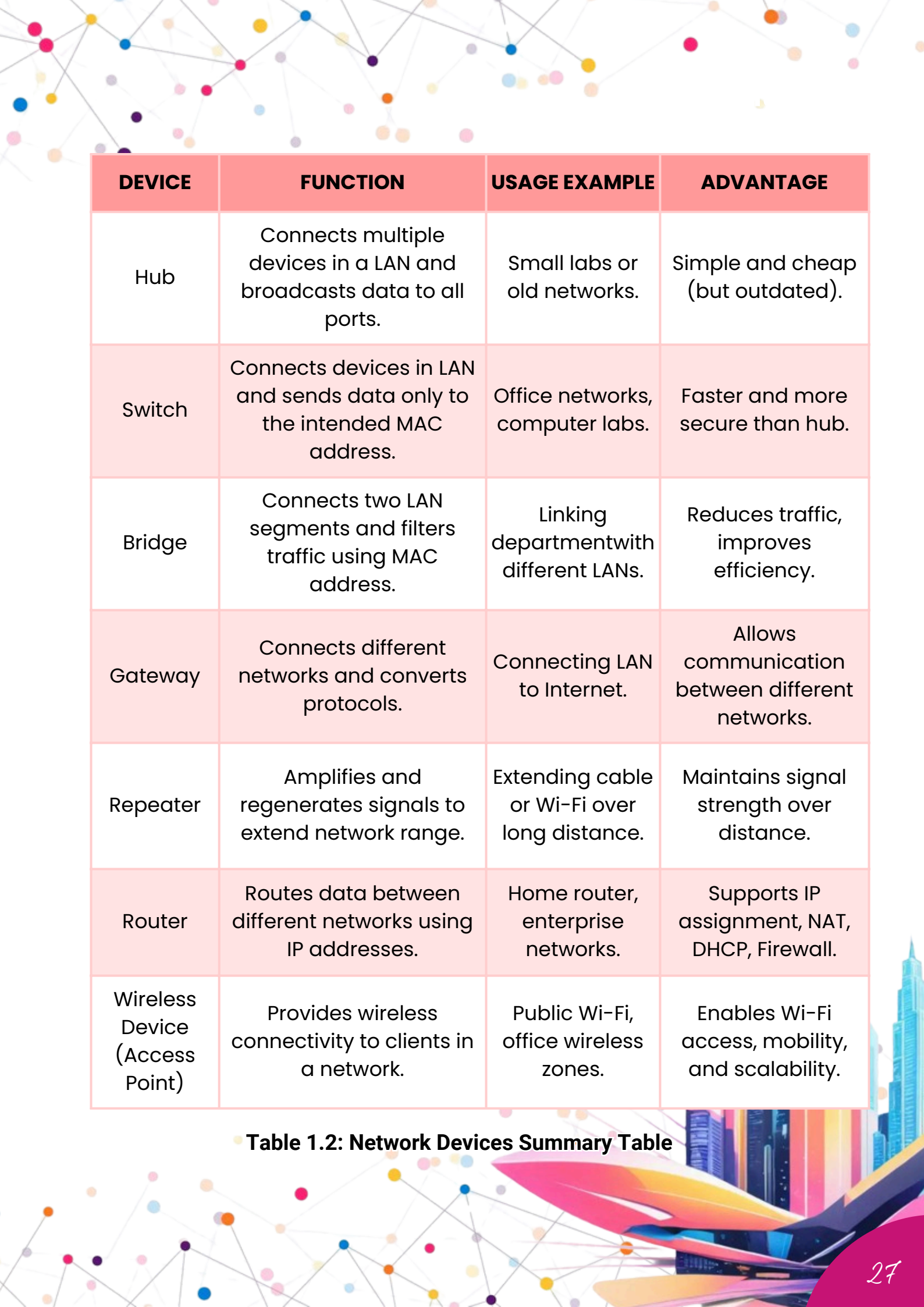


Figure 1.16: Network Devices and Their Functions



DEVICE	FUNCTION	USAGE EXAMPLE	ADVANTAGE
Hub	Connects multiple devices in a LAN and broadcasts data to all ports.	Small labs or old networks.	Simple and cheap (but outdated).
Switch	Connects devices in LAN and sends data only to the intended MAC address.	Office networks, computer labs.	Faster and more secure than hub.
Bridge	Connects two LAN segments and filters traffic using MAC address.	Linking department with different LANs.	Reduces traffic, improves efficiency.
Gateway	Connects different networks and converts protocols.	Connecting LAN to Internet.	Allows communication between different networks.
Repeater	Amplifies and regenerates signals to extend network range.	Extending cable or Wi-Fi over long distance.	Maintains signal strength over distance.
Router	Routes data between different networks using IP addresses.	Home router, enterprise networks.	Supports IP assignment, NAT, DHCP, Firewall.
Wireless Device (Access Point)	Provides wireless connectivity to clients in a network.	Public Wi-Fi, office wireless zones.	Enables Wi-Fi access, mobility, and scalability.

Table 1.2: Network Devices Summary Table

1.8 WHAT IS NETWORK TOPOLOGY?

Network topology is the way devices are connected in a network. It defines how these components are connected and how data transfer between the network. Understanding the different types of network topologies can help in choosing the right design for a specific network.

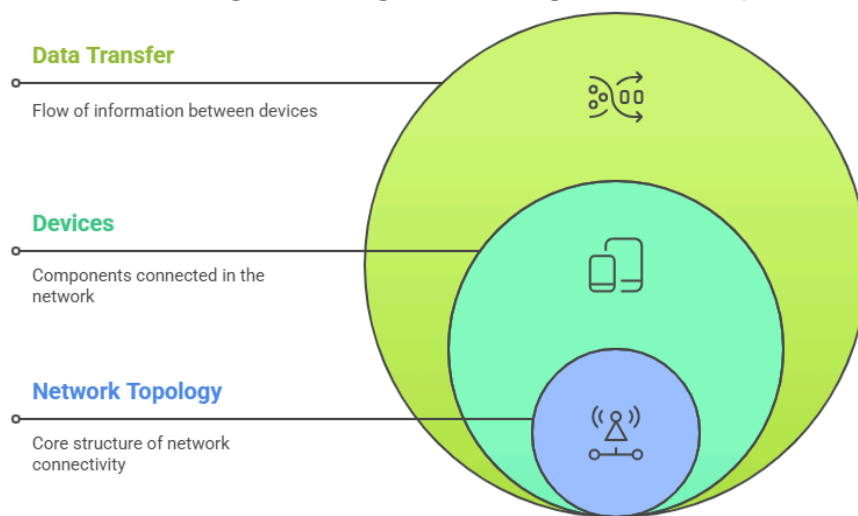


Figure 1.17: Network Topology Structure

Types of Network Topology

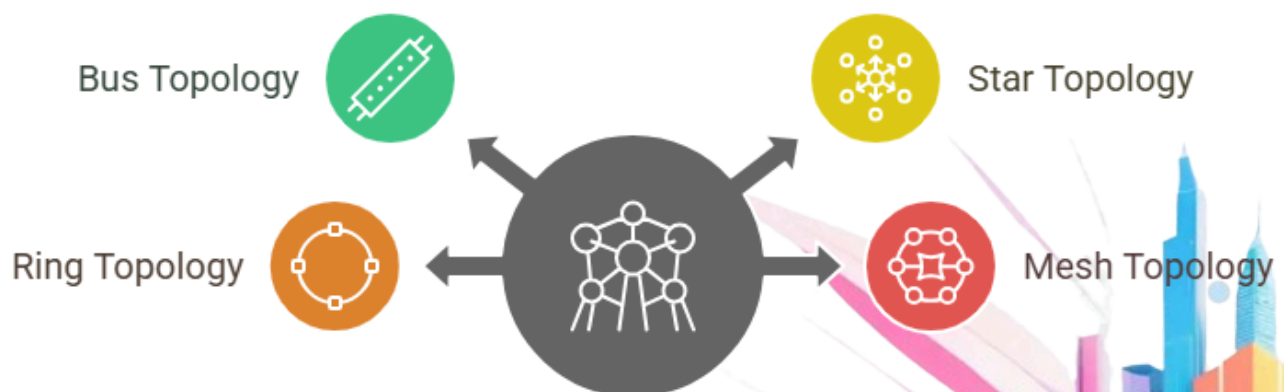


Figure 1.18: Types of Network Topology

1.8.1 BUS TOPOLOGY

- Bus Topology is a network type in which every computer and network device is connected to a single cable.
- It is bi-directional. It is a multi-point connection and a non-robust topology because if the backbone fails the topology crashes.
- In Bus Topology, various MAC (Media Access Control) protocols are followed by LAN ethernet connections like TDMA, Pure Aloha, CDMA, Slotted Aloha, etc.

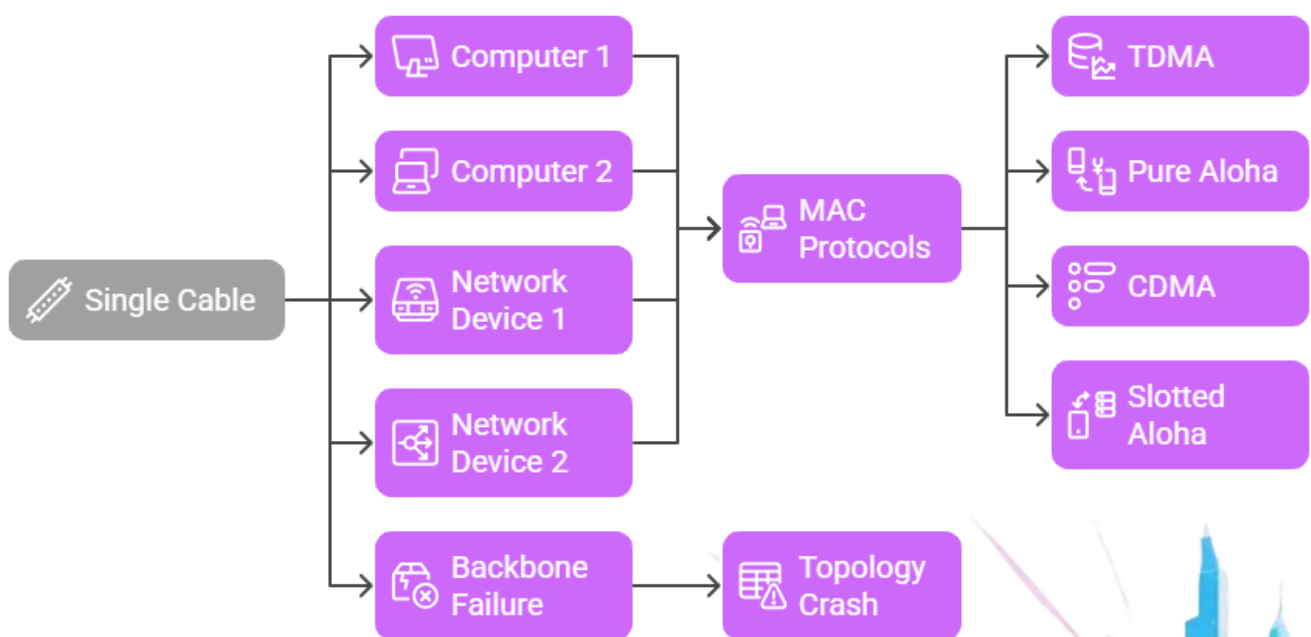


Figure 1.19: Bus Topology Network Structure

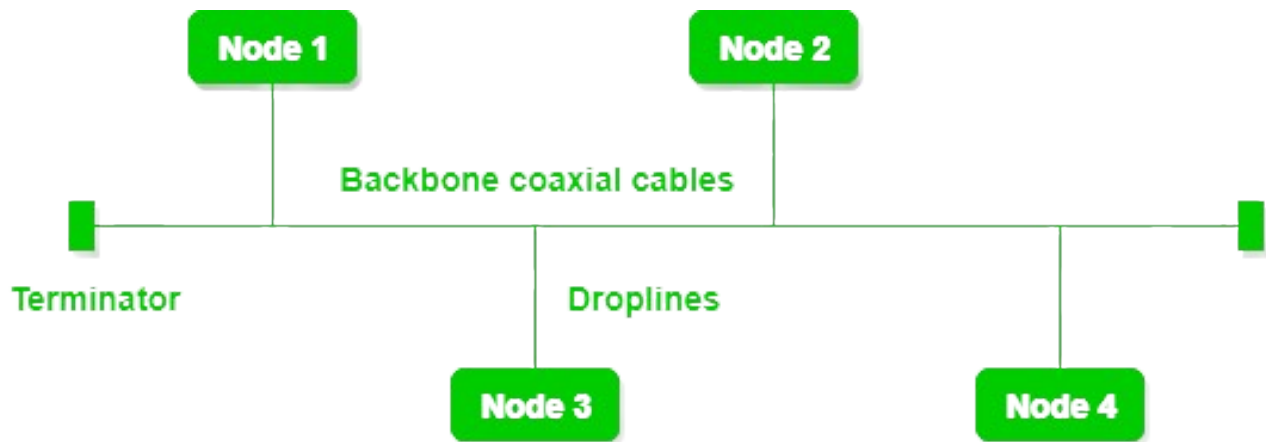


Figure 1.20: Bus Topology Diagram

<https://www.geeksforgeeks.org/types-of-network-topology/>



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<https://www.youtube.com/watch?v=dMUOQj4AwB0>



1.8.1.1 ADVANTAGES OF BUS TOPOLOGY

- 
- If N devices are connected to each other in a bus topology, then the number of cables required to connect them is 1, known as backbone cable, and N drop lines are required.

- 
- Coaxial or twisted pair cables are mainly used in bus-based networks that support up to 10 Mbps.

- 
- The cost of the cable is less compared to other topologies, but it is used to build small networks.

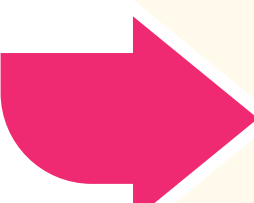
- 
- Bus topology is familiar technology as installation and troubleshooting techniques are well known.

Figure 1.21: Advantages of Bus Topology

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1.8.1.2 DISADVANTAGES OF BUS TOPOLOGY

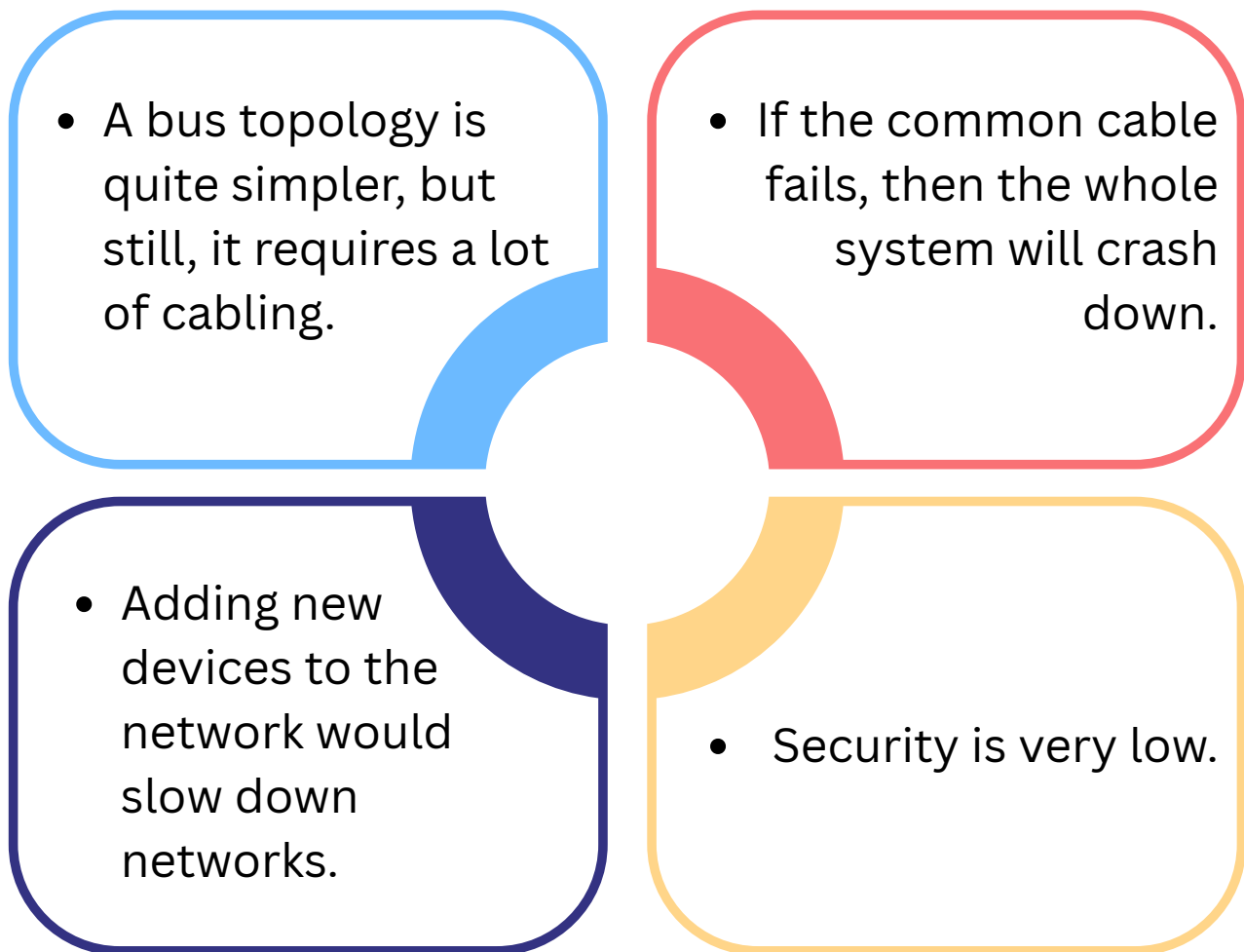


Figure 1.22: Disadvantages of Bus Topology

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A common example of bus topology is the Ethernet LAN, where all devices are connected to a single coaxial cable or twisted pair cable. This topology is also used in **cable television networks**.

1.8.2 STAR TOPOLOGY

- In Star Topology, all the devices are connected to a single hub through a cable.
- This hub is the central node and all other nodes are connected to the central node. The hub can be passive in nature i.e., not an intelligent hub such as broadcasting devices, at the same time the hub can be intelligent known as an active hub.
- Active hubs have repeaters in them. Coaxial cables or RJ-45 cables are used to connect the computers. In Star Topology, many popular Ethernet LAN protocols are used as CD(Collision Detection), CSMA (Carrier Sense Multiple Access), etc.

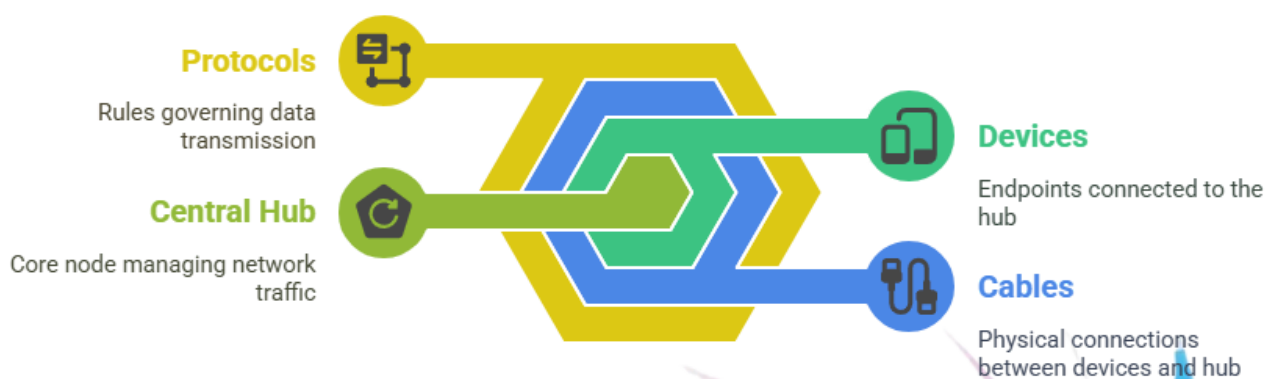


Figure 1.23: Star Topology Structure

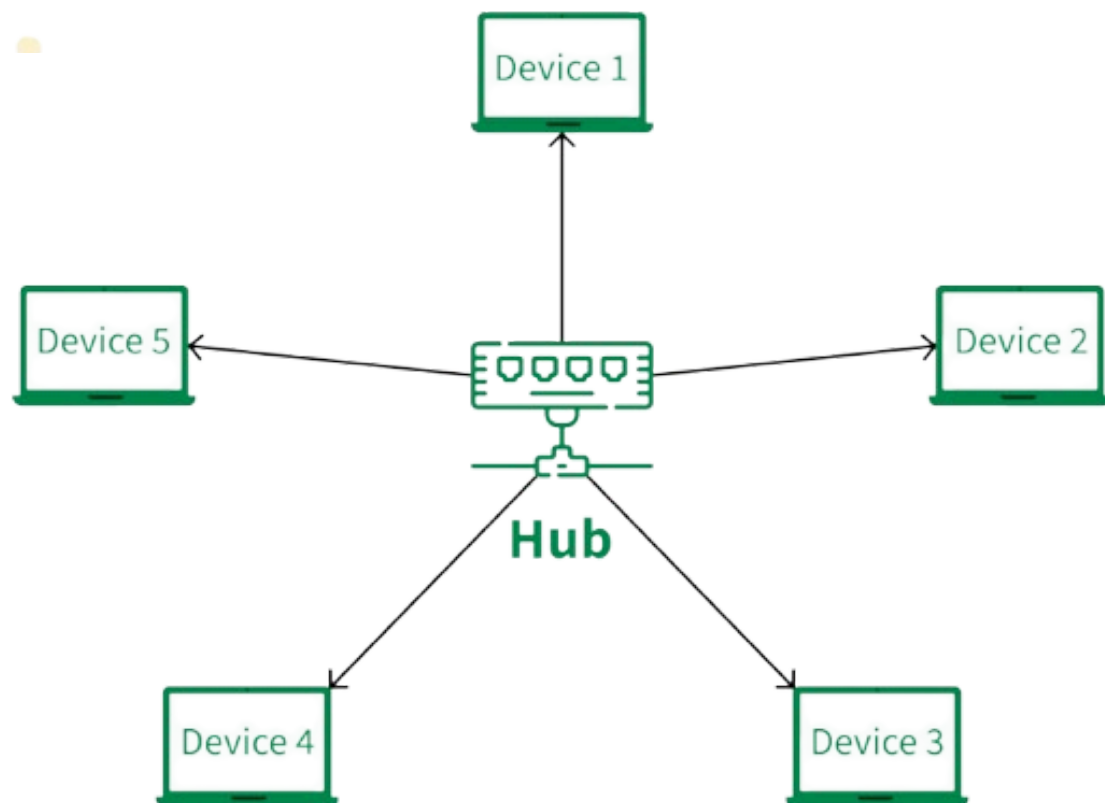


Figure 1.24: Star Topology Diagram,

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<https://www.youtube.com/watch?v=9kGM9VaVjoo>

1.7.2.1 ADVANTAGES OF STAR TOPOLOGY

1

- If N devices are connected to each other in a star topology, then the number of cables required to connect them is N . So, it is easy to set up.

2

- Each device requires only 1 port i.e. to connect to the hub, therefore the total number of ports required is N .

3

- It is Robust. If one link fails only that link will affect and not other than that.

4

- Easy to fault identification and fault isolation.

5

- Star topology is cost-effective as it uses inexpensive coaxial cable.

Figure 1.25: Advantages of Star Topology

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1.7.2.2 DISADVANTAGES OF STAR TOPOLOGY

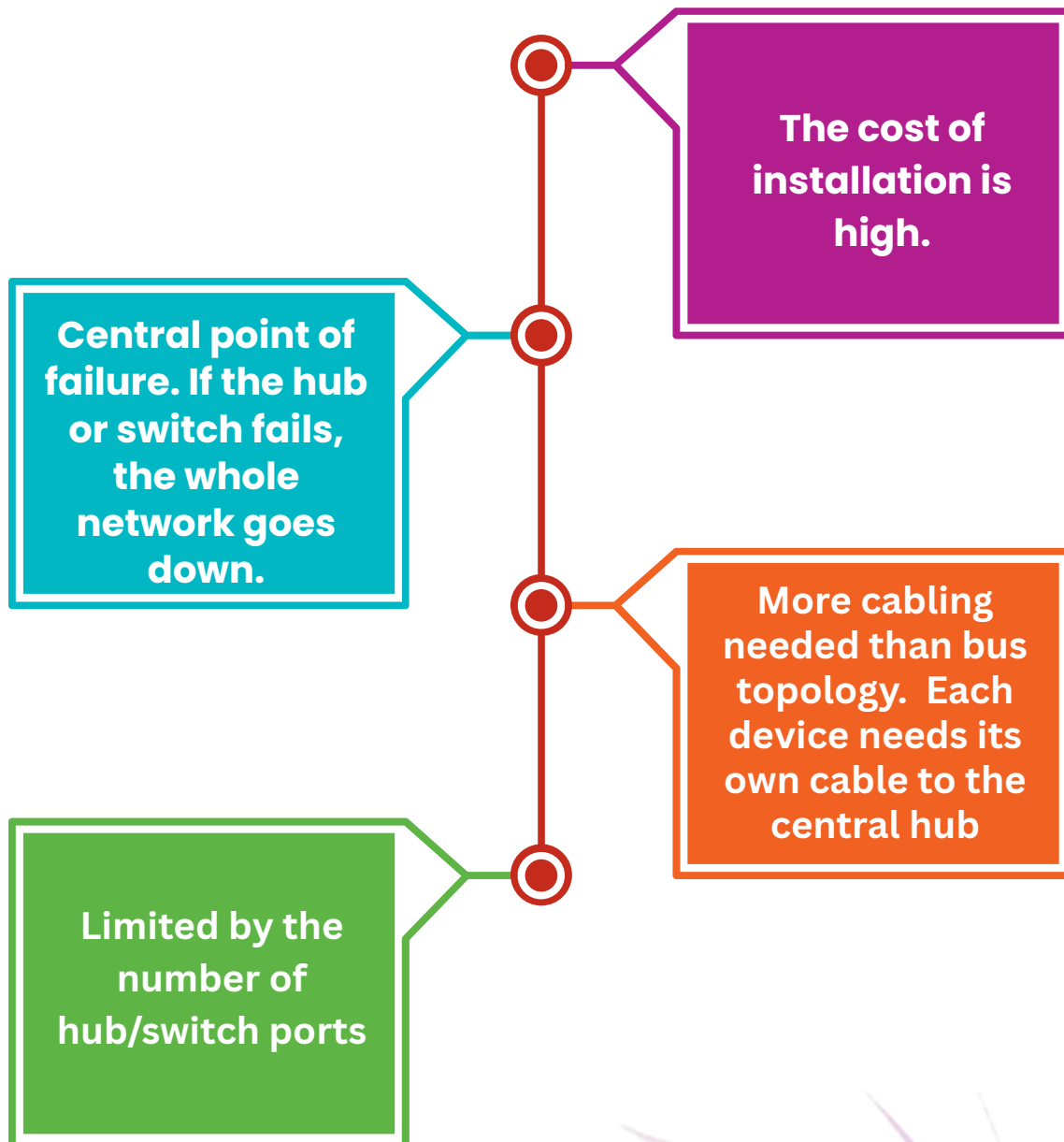


Figure 1.26: Advantages of Star Topology

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1.8.3 RING TOPOLOGY

In a Ring Topology, it forms a ring connecting devices with exactly two neighboring devices. A number of repeaters are used for Ring topology with a large number of nodes, because if someone wants to send some data to the last node in the ring topology with 100 nodes, then the data will have to pass through 99 nodes to reach the 100th node.

Hence to prevent data loss repeaters are used in the network. The data flows in one direction, i.e. it is unidirectional, but it can be made bidirectional by having 2 connections between each Network Node, it is called Dual Ring Topology. In-Ring Topology, the Token Ring Passing protocol is used by the workstations to transmit the data.



Figure 1.27: Data Transmission Cycle in Ring Topology

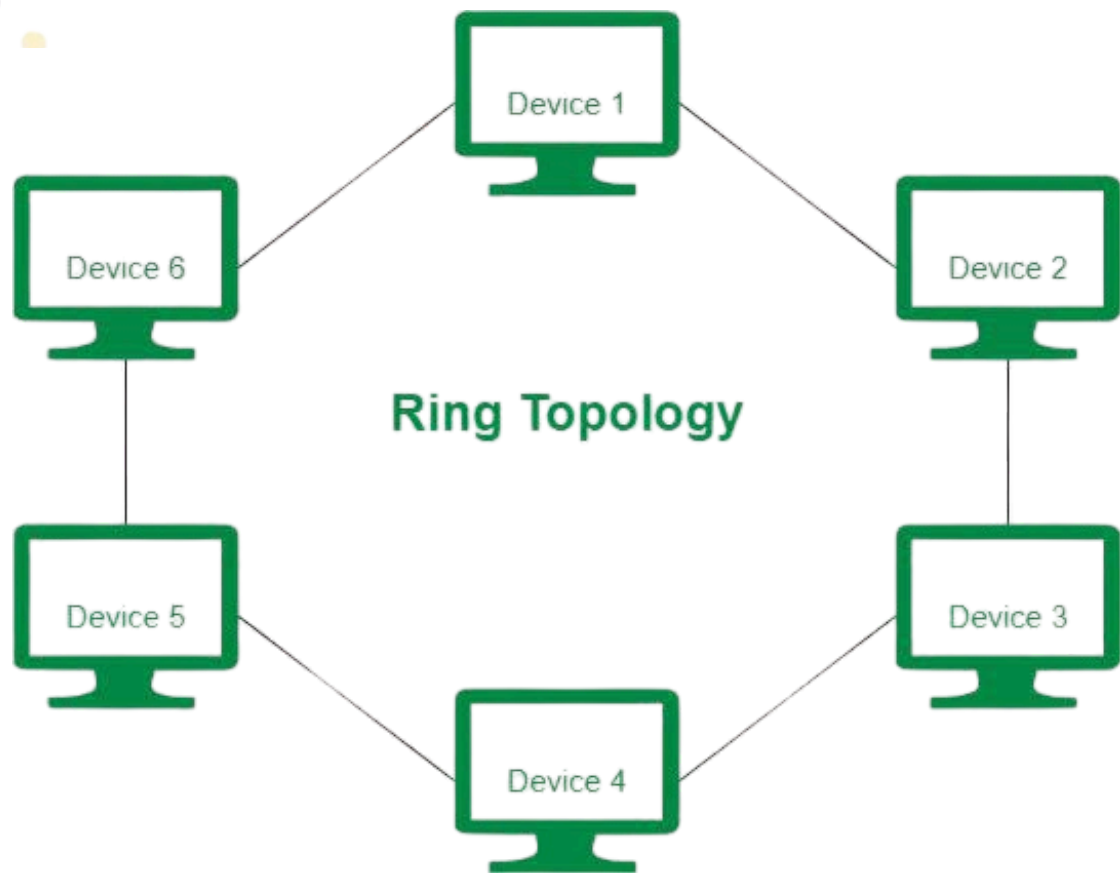


Figure 1.28: Ring Topology Diagram

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1.8.3.1 ADVANTAGES OF RING TOPOLOGY

The data transmission is high-speed.

The possibility of collision is minimum in this type of topology.

Cheap to install and expand.

It is less costly than a star topology.

Figure 1.29: Advantages of Ring Topology

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1.8.3.2 DISADVANTAGES OF RING TOPOLOGY

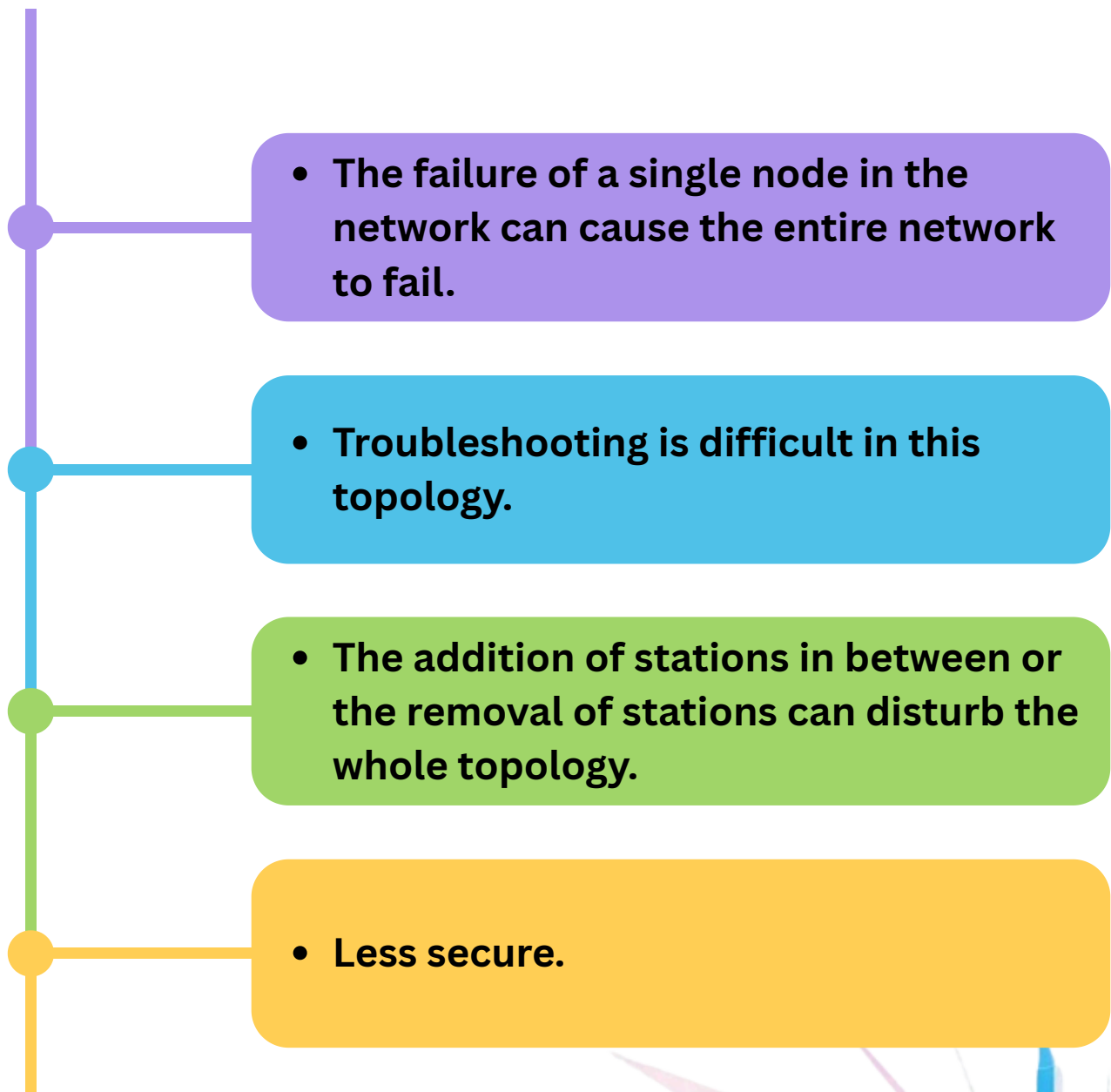


Figure 1.30: Disadvantages of Ring Topology

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ASSESSMENT

1.8 Network Topology

Scan the QR to answer the questions





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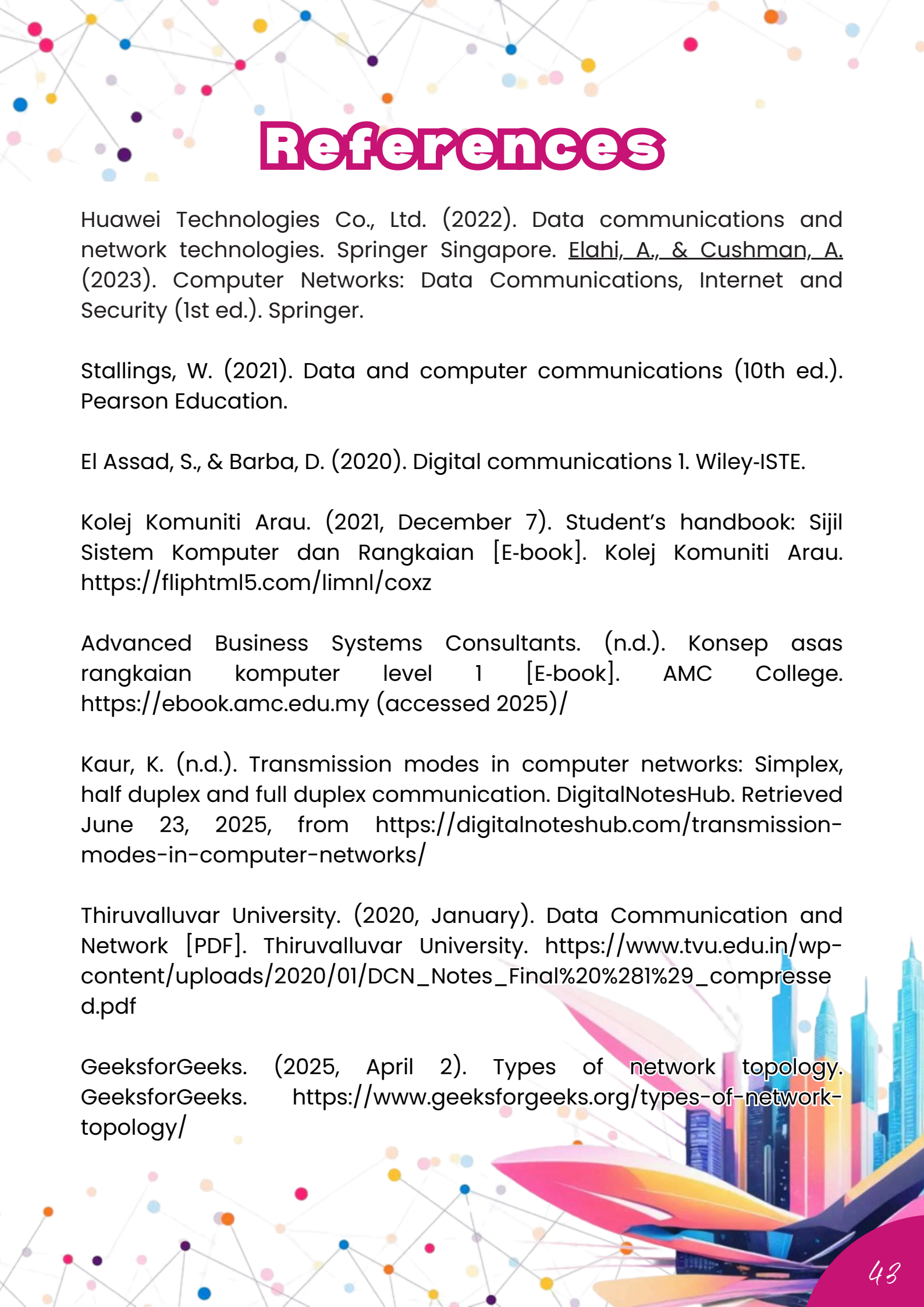
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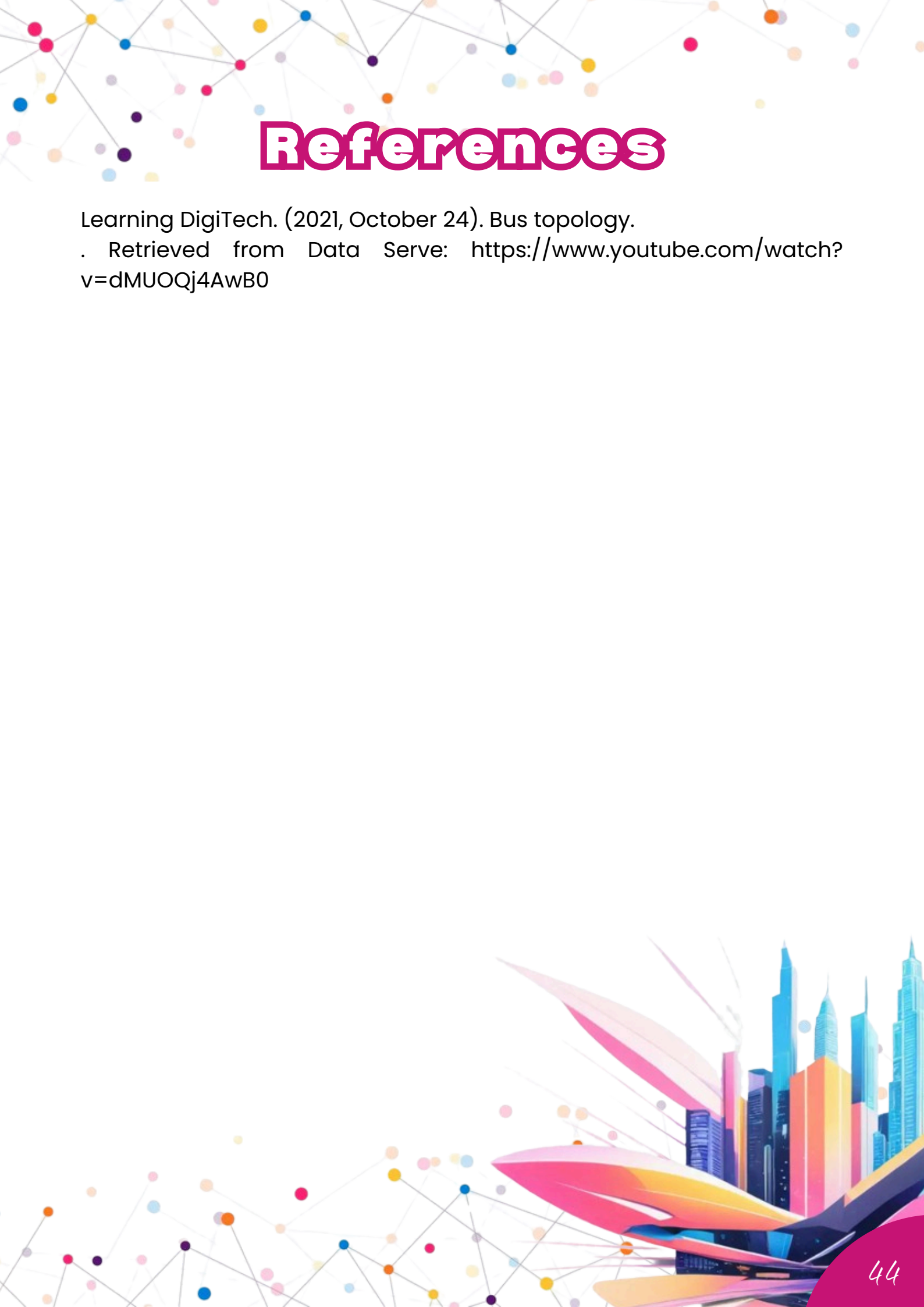
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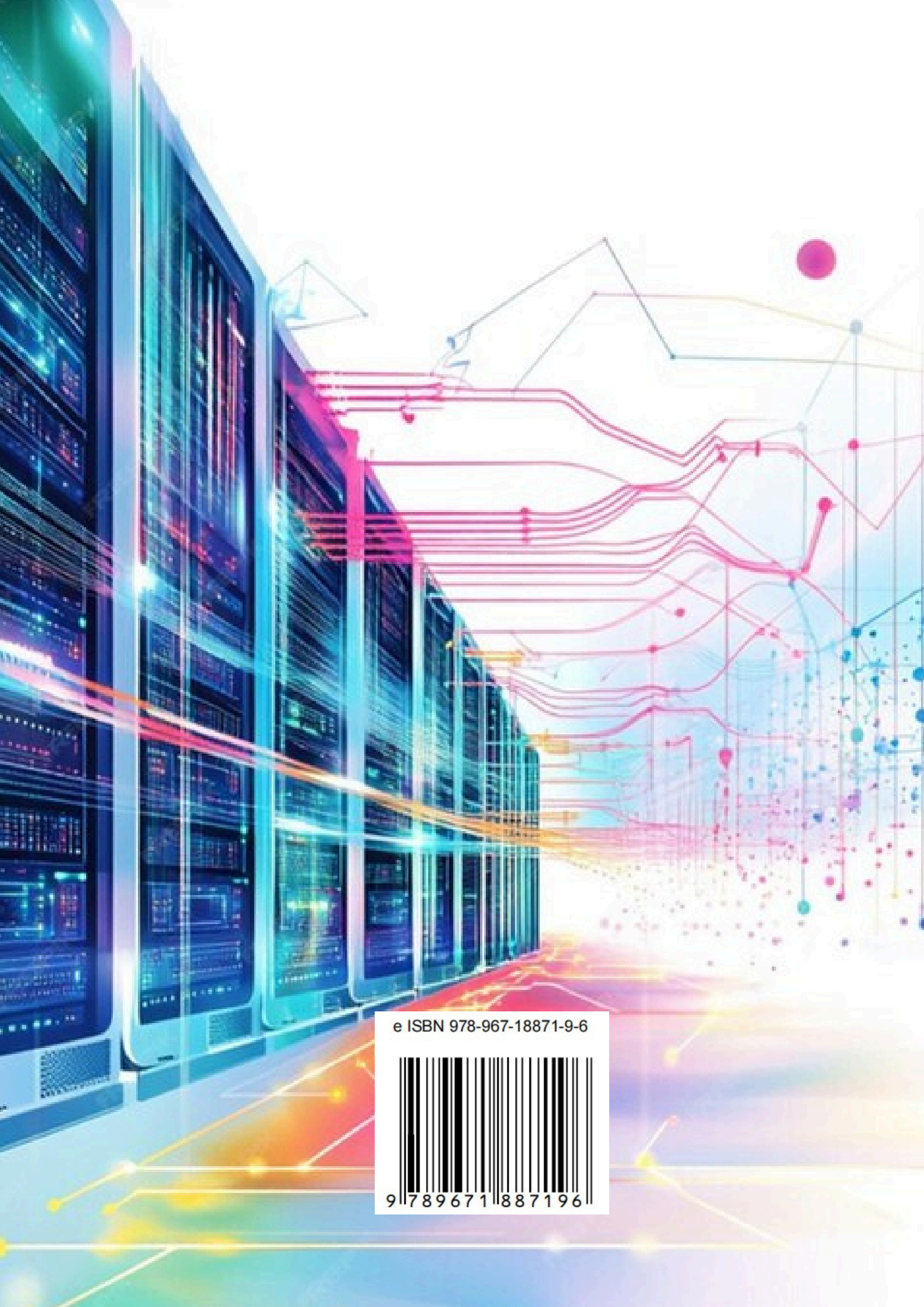
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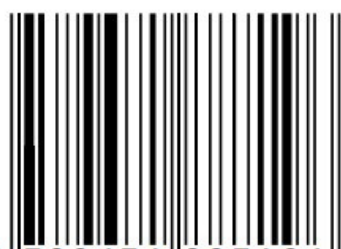
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e ISBN 978-967-18871-9-6



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