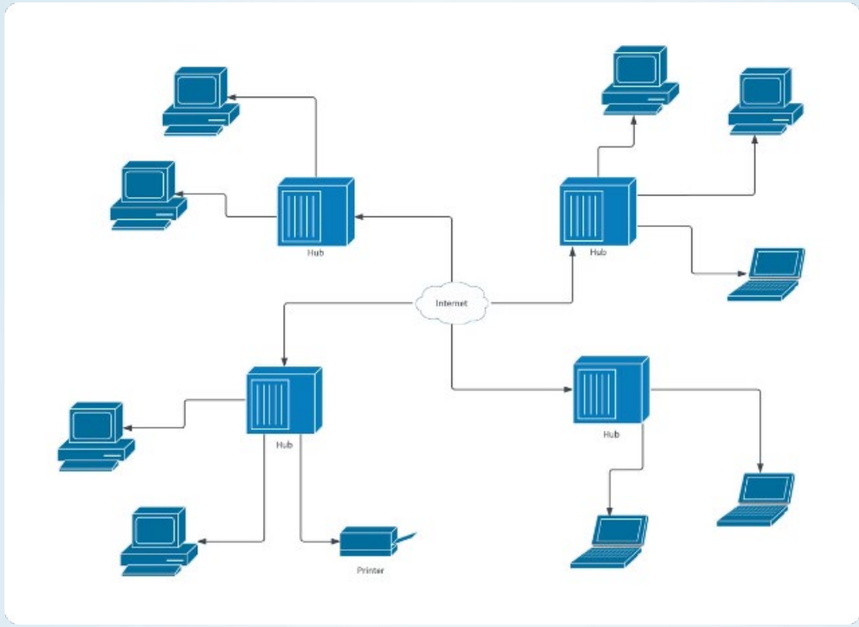

Fundamentals of Computer Networks

FCN3215

LECTURE 1. Course Introduction

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Objectives for Today

- Introduce myself to you
- Give an overview of the course and some basic information about how it will run
- Introduce Fundamentals of Computer Network to you

Course overview

Structure

15 lectures

30 labs

15 IWSGT

75 IWS

15 PE

Total 150 hours

5 credits

Assessment

Individual project

Expectations:

- Regular attendance and active participation.
- Timely submission of assignments and lab reports.

Comment

If you don’t understand information in English:

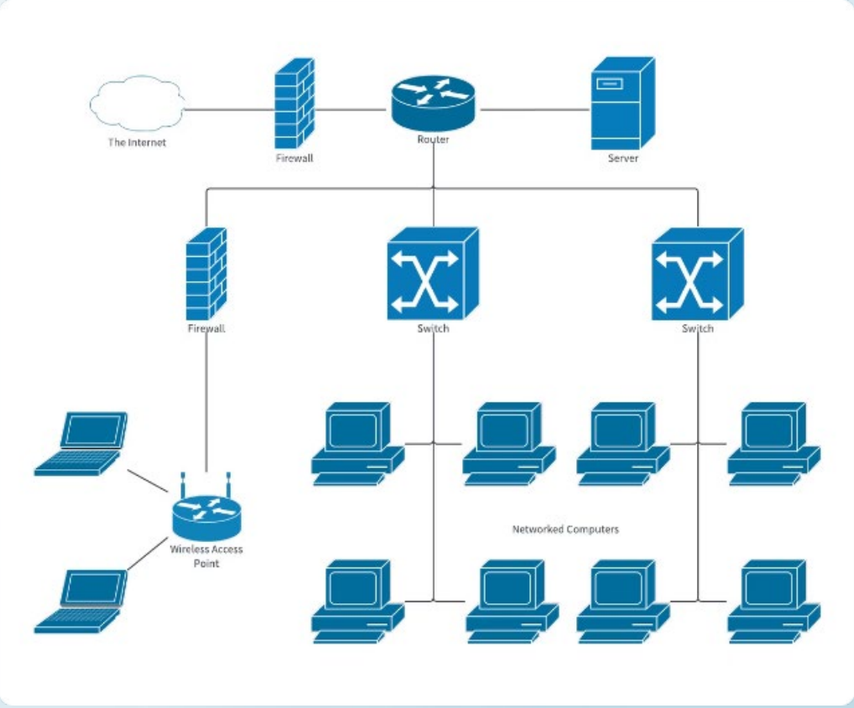
- You have slides, translate them in DeepL
- Find the same information in Russian

Course objectives

- Understand the basic concepts and principles of computer networking.
- Explore the OSI and TCP/IP models and their functions.
- Learn about various network topologies, devices, and protocols.
- Gain hands-on experience with network configuration and troubleshooting.
- Analyze network security measures and future networking trends.

Course will cover the following topics

- Introduction to Computer Networks
- OSI Model and TCP/IP Model
- Network Layers (Physical, Data Link, Network, Transport, Application)
- Network Devices and Topologies
- Network Security and Virtualization
- Wireless Networking and Cloud Computing
- Future Trends in Networking (IoT, 5G, SDN)



What is a Computer Network?

A computer network is a collection of interconnected devices that communicate and share resources.

Key Components

- Devices (computers, printers, smartphones)
- Network interfaces (NICs)
- Communication protocols

Why Are Networks Important?

1 **Resource Sharing**

Networks allow for sharing files, printers, and internet connections.

2 **Communication**

Networks support email, messaging, and video conferencing.

3 **Scalability**

Networks are scalable, meaning new devices can be added without significant changes.

4 **Reliability**

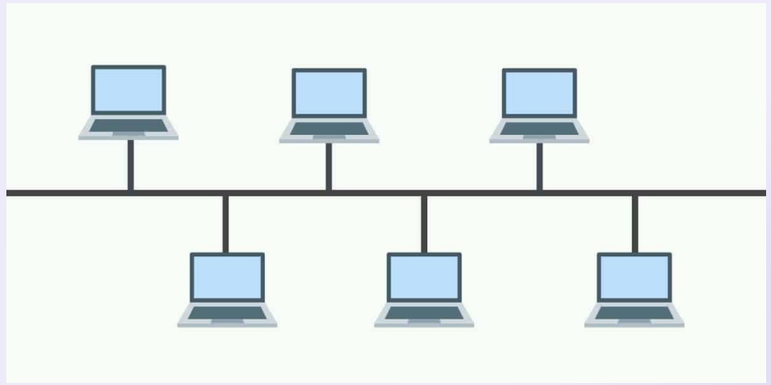
Networks enhance reliability through backup systems and redundancy.

Network Topologies

Network topology refers to the arrangement of different elements in a network.

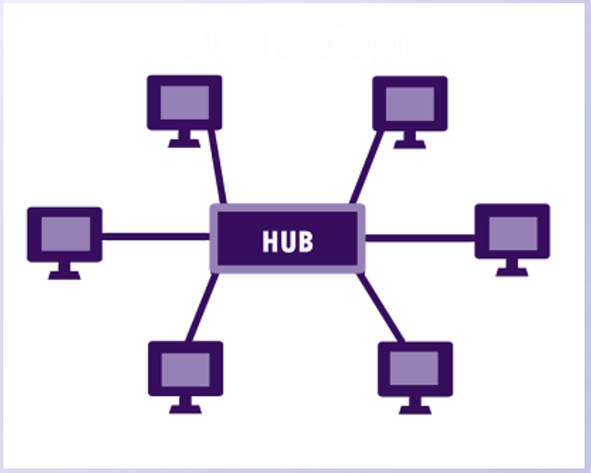
Bus Topology

Single central cable; all devices connect to it.



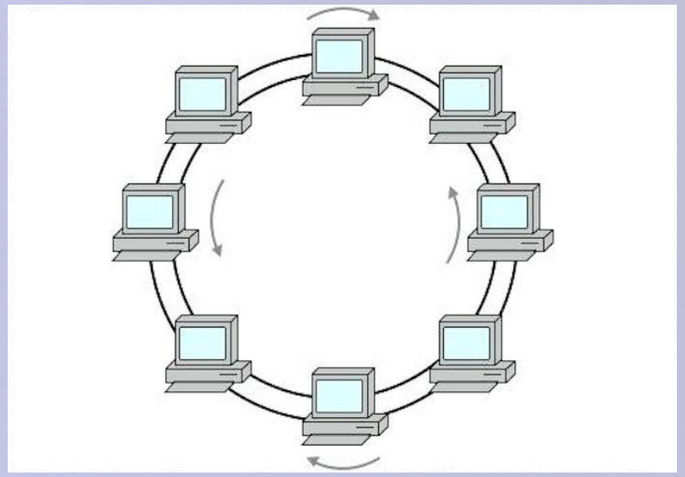
Star Topology

Central hub or switch; devices connect to the hub.



Ring Topology

Devices connected in a circular fashion.

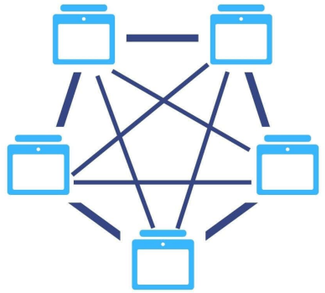


Network Topologies

Mesh Topology

Each network device connects to every other network device in the network.

Few networks today are built as a full mesh. Most networks use a partial mesh.



Types of Computer Networks

Personal Area Network (PAN)	Centered around an individual's workspace.
Local Area Network (LAN)	Connects devices within a limited area, like an office or home.
Metropolitan Area Network (MAN)	Spans city-wide networks.
Wide Area Network (WAN)	Covers larger geographical areas, such as cities or countries.

Personal Area Network (PAN)

PAN is a small network centered around an individual, typically within a range of a few meters.

Purpose: Connects personal devices such as smartphones, tablets, laptops, and wearable technology, facilitating communication and data exchange.

Personal Area Network (PAN)

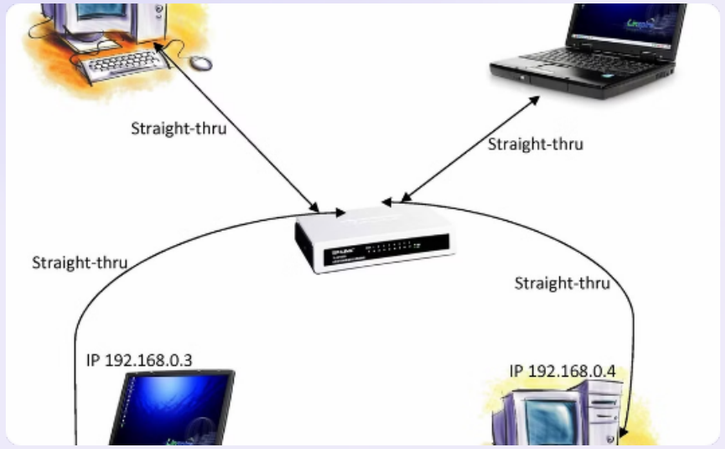
Key Characteristics:
- **Coverage:** Very limited range, typically within a few meters.
- **Ownership:** Personal networks, managed by the individual.
- **Data Transmission:** Uses technologies like Bluetooth, ZigBee, NFC, and USB.

Advantages:
- Easy to set up and manage.
- Low cost.
- Facilitates seamless communication between personal devices.

Disadvantages:
- Limited range.
- Lower data transmission speeds compared to LAN or WAN.
- Security risks if not properly configured.

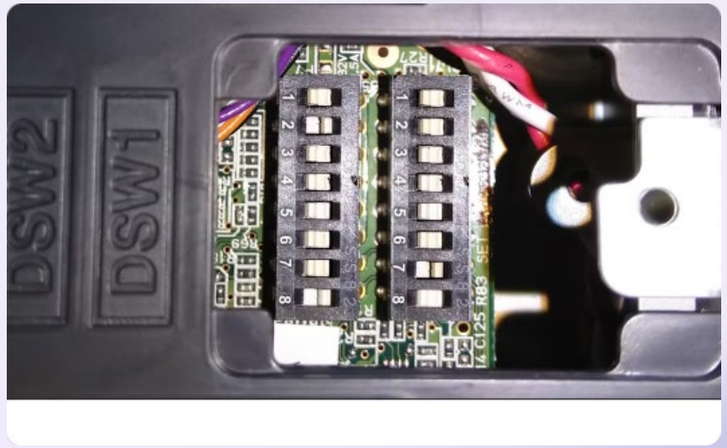
Use Cases:
- Connecting wearable devices.
- Home automation systems.
- Personal multimedia systems (e.g., smart TV connected to a smartphone).

Local Area Network (LAN)



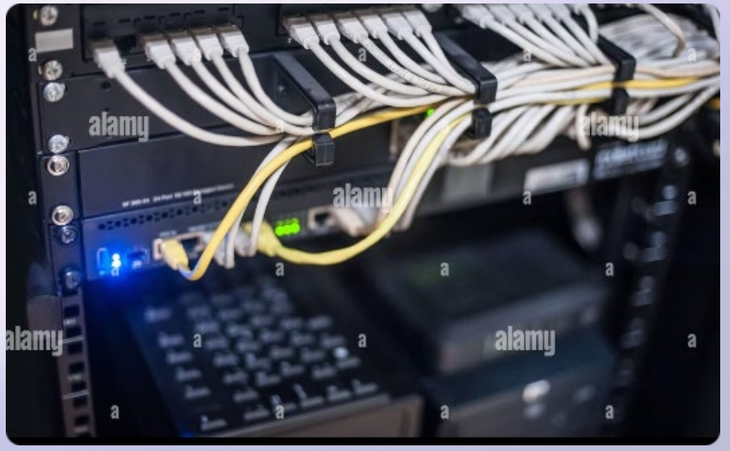
Computers

Multiple computers are connected to a switch.



Printers

Printers are also connected to the switch.



Server

A server is connected to the switch, enabling resource sharing.

Local Area Network (LAN)

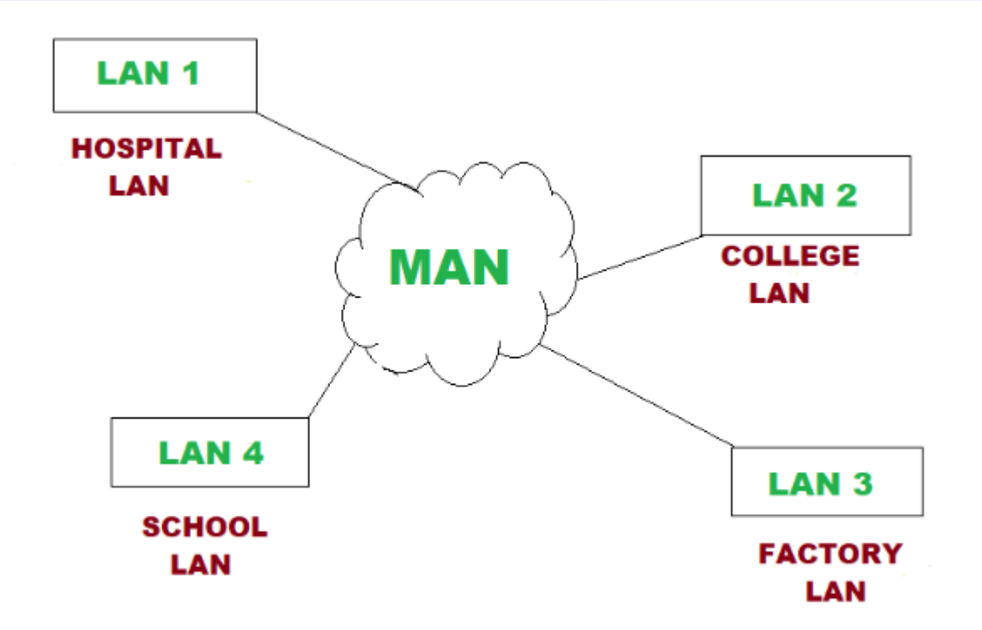
Key Characteristics:
•**Coverage:** Limited to a small geographic area, typically within a single building or campus.
•**Ownership:** Usually owned and managed by a single organization or individual.
•**Data Transmission:** High-speed data transfer through Ethernet cables, Wi-Fi, or other local transmission methods.
•**Examples:** Office networks, home Wi-Fi networks, school networks.

Advantages:
•High-speed data transmission.
•Easy to set up and manage.
•Cost-effective for small areas.
•Secure, as it is typically confined to a single location.

Disadvantages:
•Limited range, restricted to small geographical areas.
•Requires physical infrastructure like cabling.
•Network expansion can become complex as the number of devices increases.

Use Cases:
•**Businesses:** Connecting computers, printers, and servers in an office.
•**Homes:** Sharing internet access among family members and devices.
•**Schools:** Facilitating communication and resource sharing among students and teachers.

Metropolitan Area Network (MAN)



MAN is a network that covers a city or a large campus, larger than a LAN but smaller than a WAN.

Purpose: Connects multiple LANs within a city or metropolitan area, providing high-speed internet or data connectivity across multiple locations.

Metropolitan Area Network (MAN)

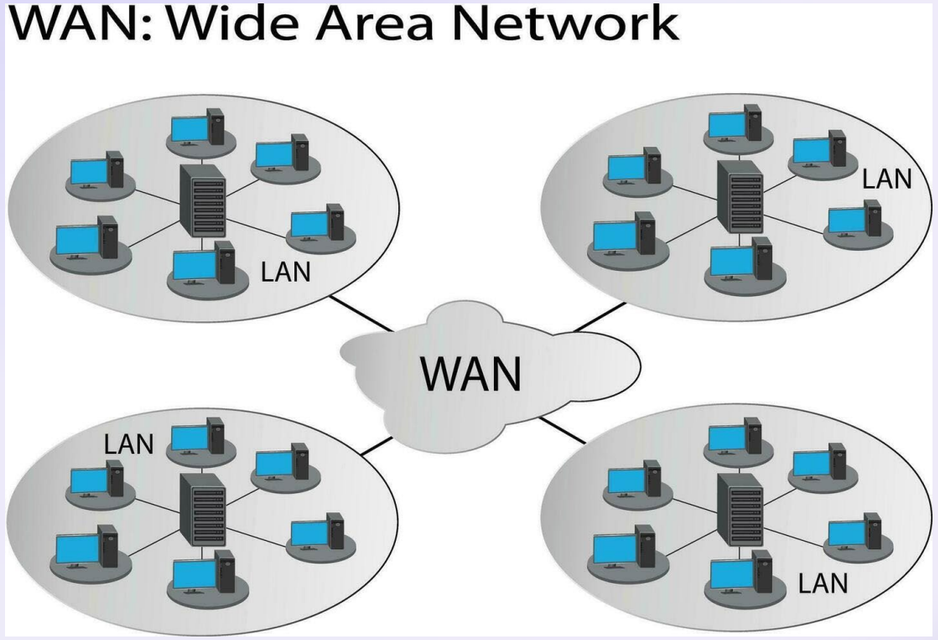
Key Characteristics:
- **Coverage:** Typically spans a city or metropolitan area.
- **Ownership:** Often owned and operated by a single organization or a service provider.
- **Data Transmission:** Utilizes technologies like Ethernet, Fiber Distributed Data Interface (FDDI), and wireless connections.
- **Examples:** City-wide Wi-Fi networks, university campus networks, and city government networks.

Advantages:
- High-speed data transmission over a wide area.
- Efficient connectivity for multiple locations within a city.
- Cost-effective compared to WANs for urban areas.

Disadvantages:
- Limited to metropolitan areas.
- Can be expensive to set up initially.
- Requires robust infrastructure.

Use Cases:
- Universities with multiple campuses.
- City governments providing public Wi-Fi.
- Businesses with multiple offices within a city.

Wide Area Network (WAN)



WAN is a network that extends over a large geographic area, such as a city, country, or even multiple countries.

Purpose: Connects multiple smaller networks, such as LANs, MANs, or other WANs, facilitating communication and resource sharing over long distances.

Wide Area Network (WAN)

Key Characteristics:
•**Coverage:** Spans large geographical areas.
•**Ownership:** Often managed by multiple organizations or telecommunications providers.
•**Data Transmission:** Uses technologies like leased lines, satellite, fiber optics, and MPLS.
•**Examples:** The Internet, corporate networks connecting global offices, and bank networks.

Advantages:
•Enables long-distance communication.
•Supports global business operations.
•Centralized data management.

Disadvantages:
•Expensive to maintain.
•Complex to manage.
•Potential for higher latency and data transmission errors.

Use Cases:
•Multinational corporations.
•Government agencies.
•Financial institutions.

Introduction to Protocols

TCP/IP Transmission Control Protocol and Internet Protocol

The backbone of the internet.

HTTP HyperText Transfer Protocol

Used for web browsing.

FTP File Transfer Protocol

Used for file transfers.

SMTP Simple Mail Transfer Protocol

Used for email.

Network Devices

1

Switch

Connects devices within a LAN.

2

Router

Connects different networks.

3

Modem

Converts digital data to analog for transmission over phone lines.

4

Access Point

Enables wireless devices to connect to a network.

Real-World Applications of Networks

1. **Business**

   Shared resources, cloud computing, remote work.

2. **Education**

   E-learning platforms, research collaboration.

3. **Healthcare**

   Telemedicine, electronic health records.

4. **Social Networking**

   Platforms like Facebook, Twitter, LinkedIn.

Recap

- Introduced FCN
- Introduced module aims, structure and outcomes