ITCC121: Week 5

Communications, Networking and Security

Discussion topics

- Comparing Analog and Digital Signals
- Function of a Modem
- Network Architecture, Topology and Types
- The OSI Model
- Wired vs. Wireless Communication
- Cyber Threats
- General Internet Safety

From Analog to Digital

What is the difference between Analog and Digital signals?

From Analog to Digital

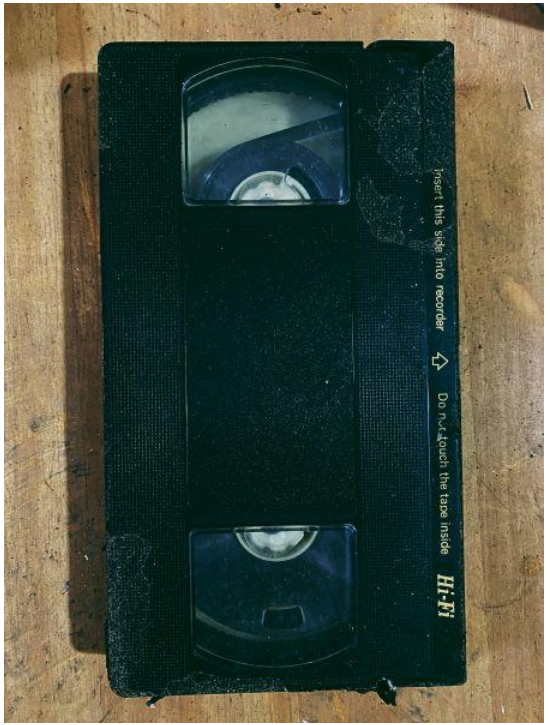
Analog: “record data linearly from one point to another” (Christensson, 2005)

Digital: the **conversion** of analog media into media that a computer can interpret

Why use Analog Signals?

Benefits include:

- Easier to process
- Low bandwidth makes it easier to synchronize
- Can store an infinite range of values (HowStuffWorks, 2000)



Why use Digital Signals?

Benefits include:

- Computers can only work with digital media
- Non-linear (can be edited and/or played back at any point in the media)
- More longevity
- Easier to copy, edit and share info
- Requires less bandwidth than analog signals

(2000)

Networking

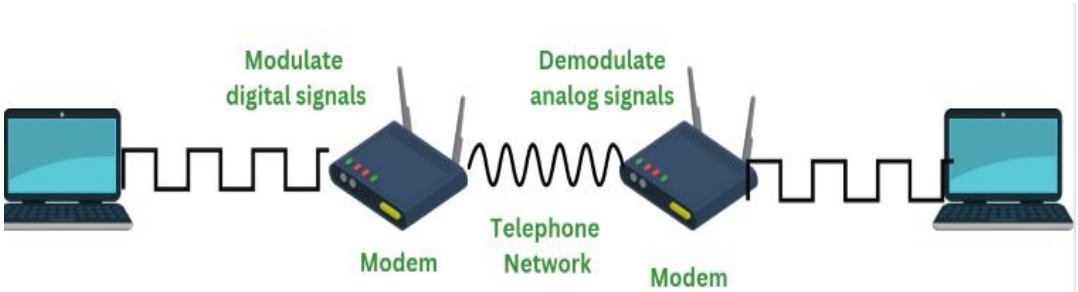
Modems Explained

- Short for Modulator/Demodulator
- Connects devices (that are linked to a network together) to the Internet (GeeksforGeeks, 2023)

How a Modem Works

1. Data Generation
2. Modulation
3. Transmission
4. Demodulation
5. Decode

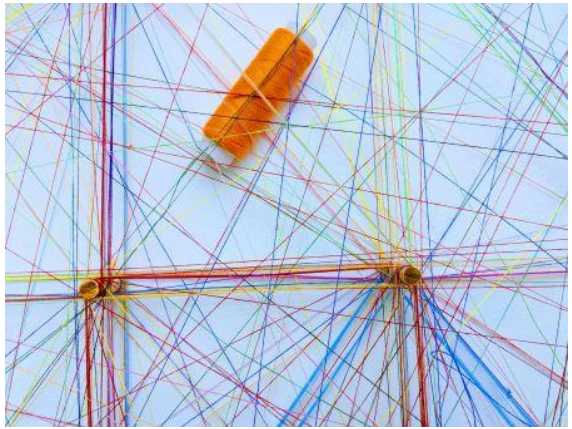
(2023)

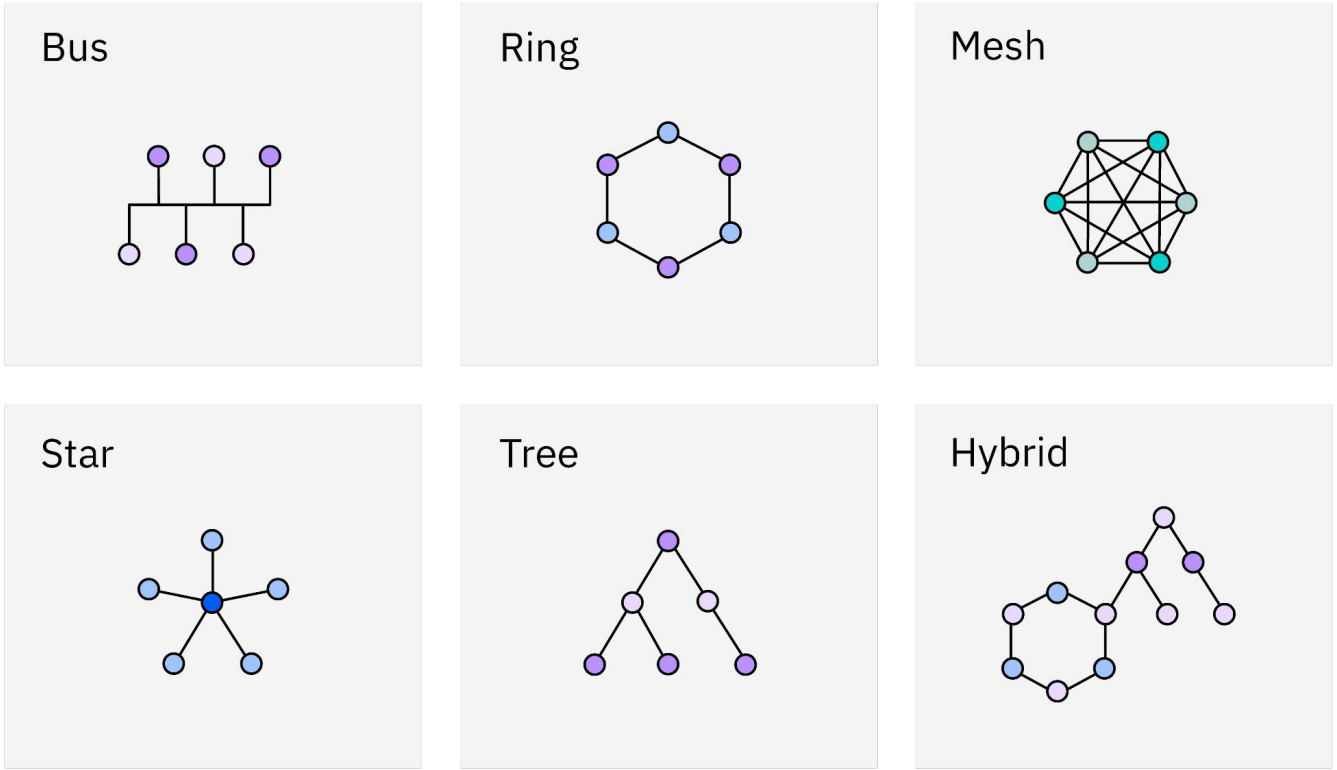


What is a Network?

A **network** is a system of different devices and systems connected to one another

- Made up of several components including a **switch, bridge, gateway, backbone and a router**
- **Topology** layouts can range from: star, ring, bus, tree, mesh and hybrid (Siddiqui, 2024)





Shows the types of network topology (Khan & Jackson, 2024)

Benefits and Drawbacks of Computer Networks

Positive:

- Sharing of hardware and software
- Easier collaboration
- Access databases more quickly and efficiently
- Increased security

(Walton, n.d.)

Negative:

- Poses some security risks
- Can cause distraction in the workplace
- Presence of cyber threats
- Higher costs
- Requires daily maintenance

Network Types

Several types of networks are used modern day, including:

- WAN (Wide Area Network)
- MAN (Metropolitan Area Network)
- LAN (Local Area Network)
- WLAN (Wireless LAN)
- VPN (Virtual Private Network)

(NetXL, 2021)

Network Architecture

- How a computer network is designed
- Can includes elements of software and hardware
- Contains: topology, the client, switch, protocols and transmission media (Siddiqui, 2024)

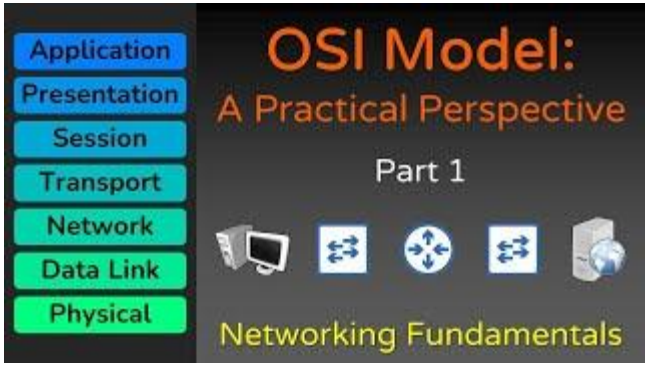
Types of Network Architectures

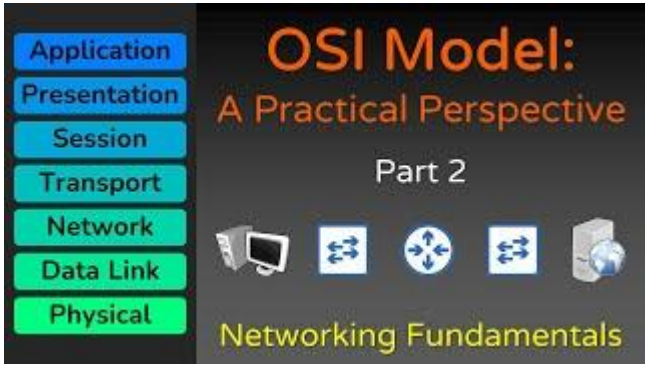
- Peer-to-Peer
- Client-server
- Hybrid network
- Cloud-based
    - Includes both the front-end and back-end

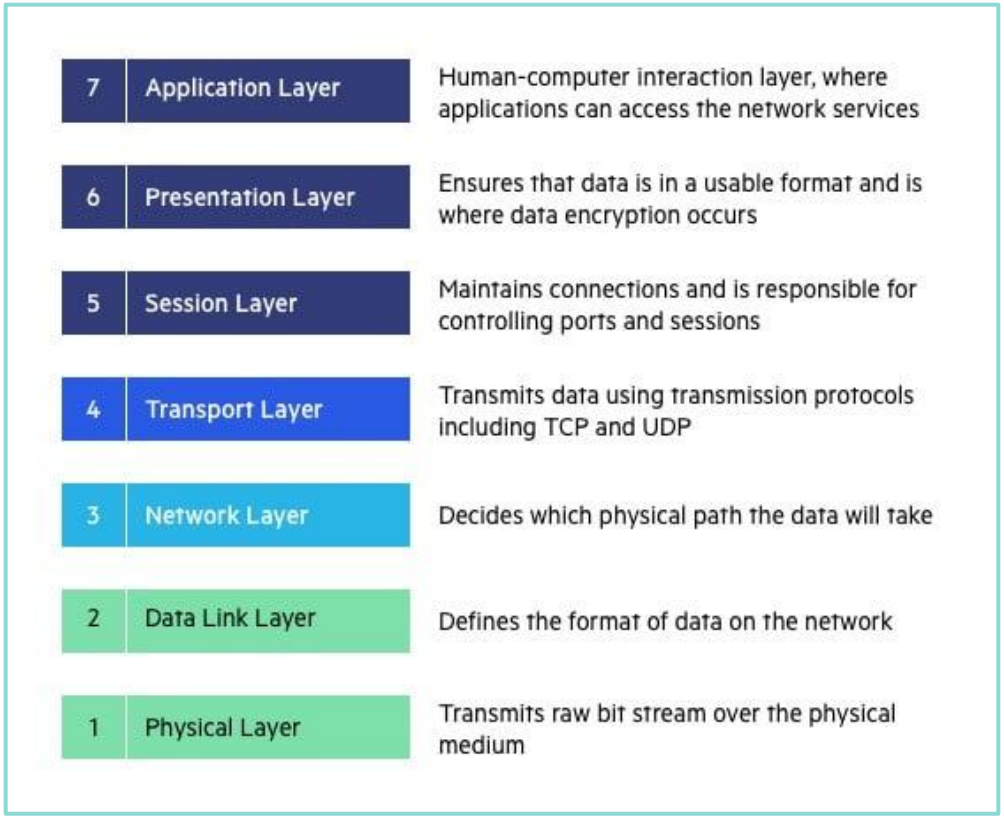
(2024)

OSI Model Explained

- Stands for Open System Interconnection Model; describes how computers interact with each other within a network (Hertvik, 2023)
- Includes **7 essential layers**







The OSI Model with steps (Imperva, n.d.)

Wired vs. Wireless Communication

Wired: relies physical/analog media (wires) to connect devices to a network (GeeksforGeeks, 2021)

- Examples: **twisted-pair, co-axial, fiber-optic**

Wireless: relies on infrared waves (or digital media) to connect devices to a network (2021)

- Examples: **infrared, radio waves, microwaves**

Cyber Threats, Hackers, and How to Stay Safe

Cybersecurity

- Defined as “the practice of protecting digital devices, networks, and sensitive data from cyber threats such as hacking, malware, and phishing attacks” (GeeksforGeeks, 2025)
- Cybersecurity is crucial to maintain by anyone using a network, the internet, or any device containing sensitive information.

Types of Cybersecurity

- Network Security
- Application Security
- Data Security
- Cloud Security
- Endpoint Security
- Operational Security
- Internet of Things (IoT) Security

(2025)

What do Hackers Do?

- Search for vulnerabilities on your device’s software or network in order to exploit (2025)

Types of Cyber Threats

- Malware
- Phishing
- Ransomware
- DDoS (Distributed Denial-of-Service)
- SQL & NoSQL Injection
- Zero-Day Exploits & APT (Advanced Persistent Threats)
- MITM (Man-In-the-Middle)
- Insider Threats & Privilege Misuse

(2025)

How to AVOID Cyber Threats

- Strong passwords
- Use up-to-date software
- Two-factor authentication
- Educate self on cyber threats and cybersecurity trends
- Be wary of sketchy/unfamiliar applications, software, emails, etc.

(2025)

Conclusion

Summarized Points

- The difference between Analog and Digital Signals with benefits of each
- Significance of a Modem and its connection to networking
- The function of, uses of and types of computer networks
- Purpose of the OSI Model
- Difference between wired and wireless media
- Key components of cybersecurity
- Tips to avoid cyber threats

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