Lecture 4: Access Networks - Expanded Overview

# 1. What are Access Networks?

Access networks are the 'last mile' of communication — the part of the network that connects end users to the internet backbone. Example: Think of the internet as a big highway system. Access networks are the small roads that connect your home to the highway.

# 2. Importance of Access Networks

- Enable fast, reliable communication (voice, video, data)  
- Reduce long-distance costs by carrying large amounts of data  
- Help businesses expand globally (fiber and satellite)  
👉 Without access networks, you couldn’t watch YouTube, call on WhatsApp, or stream Netflix.

# 3. Types of Access Networks

A. Wired Access Networks

- DSL: Uses telephone line for internet + voice simultaneously.  
- Cable Internet: Uses TV cable for faster internet.  
- Fiber Optics: Uses light in glass cables, fastest and most reliable.  
- Ethernet: Common in LANs for offices/homes.

B. Wireless Access Networks

- Wi-Fi: Short range, in homes/cafes.  
- Cellular (4G/5G): Mobile towers, internet anywhere.  
- Satellite: Covers remote areas (ships, deserts).

C. Hybrid Access Networks

- Combines multiple technologies (e.g., Fiber + Wi-Fi).

# 4. Digital Subscriber Line (DSL)

DSL is internet via telephone copper line. Allows simultaneous internet and phone use. DSL replaced dial-up connections.

## Types of DSL

1. SDSL: Symmetric, equal upload/download, good for offices.  
2. SHDSL: Faster symmetric DSL, used in corporate LANs.  
3. ADSL: Asymmetric, faster download than upload, best for homes.  
4. RADSL: Adjusts speed based on distance.  
5. DSL Lite: Splitter at central office, simpler.  
6. VDSL/VDSL2: Very high speed, supports HDTV and video calls.

# 5. How DSL Works

DSL Modem → Telephone Line → DSLAM at ISP.  
Steps:  
1. Modem self-test.  
2. Checks PC connection.  
3. Sync with DSLAM (green light if successful).

DSL Splitter: Separates voice and data signals to use both at once.

# 6. DSL Compared with Others

- DSL vs Cable: DSL is slower but stable. Cable is faster but shared.  
- DSL vs Wi-Fi: DSL is wired/stable, Wi-Fi is wireless/flexible but weaker range.

# 7. Benefits of DSL

- Cheap (uses existing phone line)  
- Always-on internet  
- Simultaneous voice + data  
- Easy setup  
- Supports multiple devices

# 8. Disadvantages of DSL

- Speed decreases with distance from ISP  
- Limited bandwidth  
- Depends on copper wires (old tech)  
- Security risks if not protected

# 9. Transmission Media

Guided (Wired): Twisted Pair, Coaxial Cable, Optical Fiber  
Unguided (Wireless): Radio, Microwave, Infrared

# 10. Propagation in Wireless

- Ground Propagation: Follows earth surface (radio)  
- Sky Propagation: Bounces off ionosphere (AM/FM)  
- Line of Sight: Direct antenna to antenna (cellular/satellite)

# Sample Questions and Answers

Q: What is DSL?  
A: DSL is a broadband technology using telephone copper wires for internet + voice calls simultaneously.

Q: Why is Fiber better than DSL?  
A: Fiber uses light signals, offering faster speed, no interference, and long-distance reliability.

Q: Compare DSL vs Wi-Fi.  
A: DSL = wired, stable. Wi-Fi = wireless, flexible but limited range.

# Important Exam Questions

1. Define Access Networks and explain importance.  
2. Differentiate between Wired, Wireless, and Hybrid networks.  
3. Explain how DSL works with diagram.  
4. Compare ADSL and SDSL.  
5. Advantages and Disadvantages of DSL.  
6. Compare DSL vs Cable Internet.  
7. Explain transmission media types.  
8. Explain propagation methods in unguided media.  
9. Compare Fiber, Coaxial, and Twisted Pair.  
10. Short notes on Wi-Fi, Cellular, Satellite.

# Self Study Questions and Answers

Q1: DSL vs Fiber Optic?  
A1: DSL uses copper wires (slower, limited distance). Fiber uses glass (light signals, faster, long-distance).

Q2: DSL vs Dial-up?  
A2: Dial-up blocks phone line and is very slow. DSL allows internet + voice at same time with higher speed.