Services Provided by Telephone Networks, Dial-Up Service, Digital Subscriber Line (DSL)

Course Title: Data Communication
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Sourav Debnath
Roll: 22CSE009
Department of CSE
University of Barishal

Services Provided by Telephone Networks

Analog Services/Analog Switched Services

1 Dial-up service

The familiar dial-up service most often encountered when a home telephone is used

2 Analog signal

The signal on a local loop is analog, and the bandwidth is usually between 0 and 4000 Hz

3 Local call service

Local call service is normally provided for a flat monthly rate

4 800 service

Free for the caller, paid by the organization

5 Toll call types

A toll call can be intra-LATA or inter-LATA

6 WATS

WATS (Wide-area telephone service): Outbound calls paid by organizations, cheaper than regular toll calls.

7 900 services

Inbound calls paid by caller, more expensive than normal long-distance call, causes includes extra service charges

Analog Leased Line Services

1 2 3

Lease line

Offers customers the opportunity to lease a dedicated line

Permanent connection

Always-on connection between two users

No dialing

No dialing is needed as the switch is always closed

Digital Services

More resistant to noise and interference than analog services.

1. Switched/56 Services

Data rates	Subscription	Equipment
Allows data rates up to 56 kbps	Both users must subscribe	Subscribers need a Digital Service Unit (DSU) instead of modem

2. Digital Data Service

Data rates	High-speed	Protocol
Allows data rates up to 64 kbps	High-speed data transmission	Enabling applications like Voice over Internet Protocol (VoIP)

Dial-Up Service

Traditional Telephone Lines

- Traditional telephone lines, also known as the Plain Old Telephone System (POTS)
- When you speak, your voice is converted into an electrical signal, which travels down the copper wire to the other end, which is converted back into sound.
- Frequency range

  Carry frequencies between 300 and 3300 Hz
- Data transmission

  Effective bandwidth for data transmission is 2400 Hz (600-3000 Hz)
- Design basis

  Modern design still based on traditional capabilities

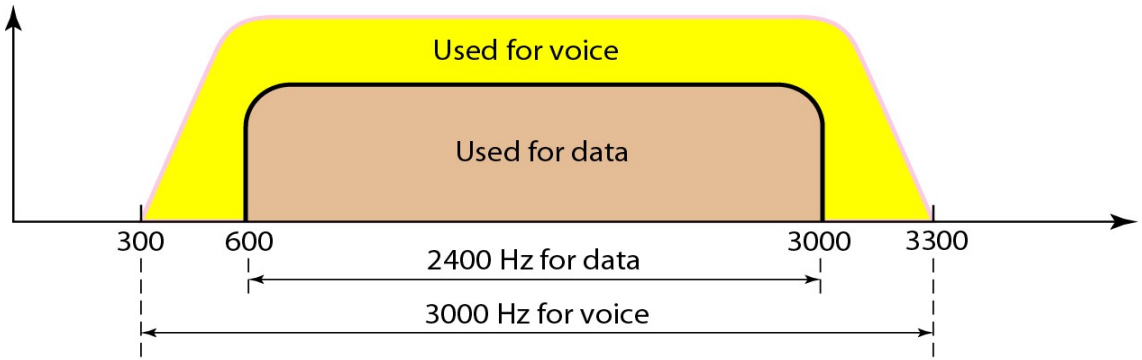


Figure 1: *Telephone line bandwidth*

Modem

Stands for Modulator/Demodulator

Modem

- The computer sends a digital signal to the modulator portion of the modem; the data is sent as an analog signal on the telephone lines.
- The modem on the right receives the analog signal, demodulates it through its demodulator, and delivers data to the computer on the right.
- It **converts** digital signals to analog and vice versa.

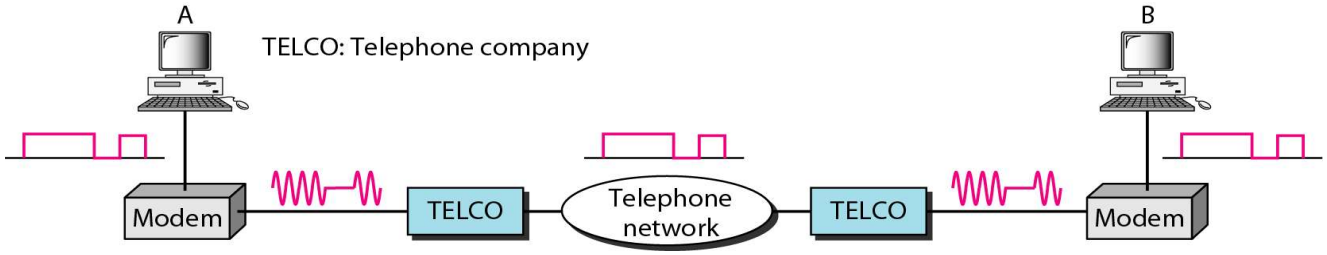


Figure 2: *Modulation/Demodulation*

Modem Technology

- There are **two** types of Modems
  - Traditional Modems
  - 56K Modems

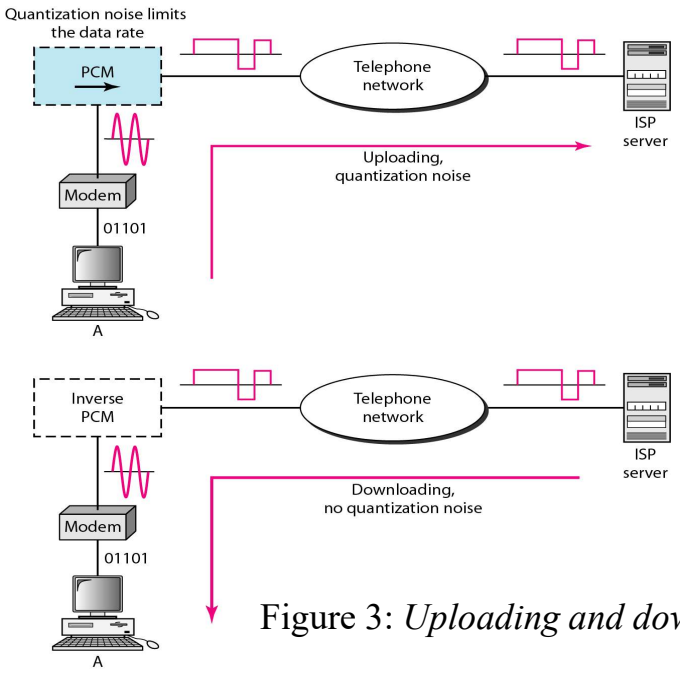


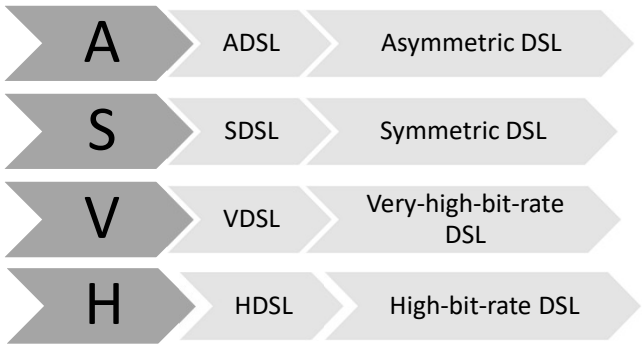
Figure 3: *Uploading and downloading in 56K modems*

Modem Type	Max Download Speed	Max Upload Speed	Technology
Traditional	33.6 kbps	33.6 kbps	Analog
56K	56 kbps	33.6 kbps	Digital/Analog Hybrid

Digital Subscriber Line (DSL)

Digital Subscriber Line (DSL)

- DSL allows simultaneous **voice and data** transmission.
- DSL works by using different frequencies on the line, with DSL signals operating at high frequencies while traditional phone calls use lower frequencies.
- It was developed for **high-speed** internet access.
- **Frequency Range:** around **25 kHz up to 1.1 MHz**.
- Faster speeds than traditional dial-up.
- Set of technologies (ADSL, SDSL, VDSL, HDSL) collectively called xDSL.



Digital Subscriber Line (DSL)

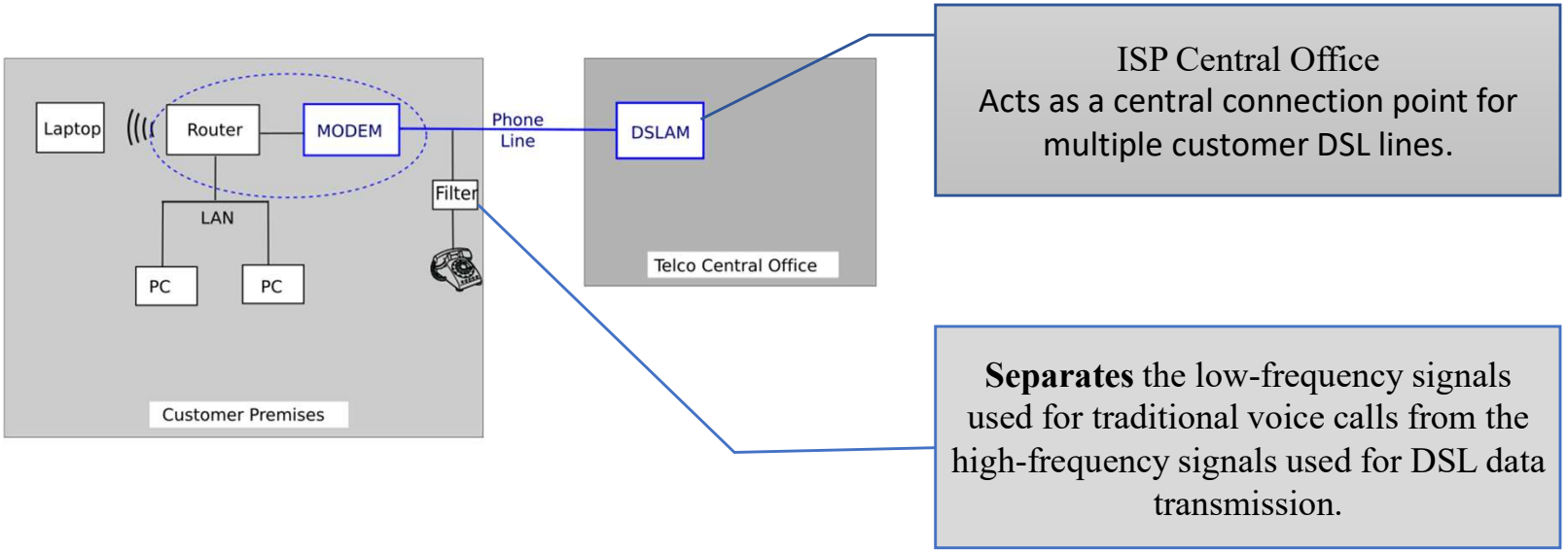


Figure 4: *DSL Connection*

Asymmetric Digital Subscriber Line (ADSL)

Infrastructure

Uses existing telephone lines (local loop)

Bandwidth

Twisted-pair cable can handle bandwidths up to 1.1 MHz

Channel division

Divides bandwidth into voice channel, upstream channel, and downstream channel

Simultaneous use

Allows simultaneous voice and data communication

Upstream speed

Upstream can reach 1.44 Mbps (normally below 500 kbps)

Downstream speed

Downstream can reach 13.4 Mbps (normally below 8 Mbps)

ISP role

Telephone company serves as ISP

Discrete Multitone Technique (DMT)

In the ADSL technology, **Discrete Multitone (DMT)** is the **standard line coding and modulation technique** used to transmit high-speed digital data over copper telephone lines.

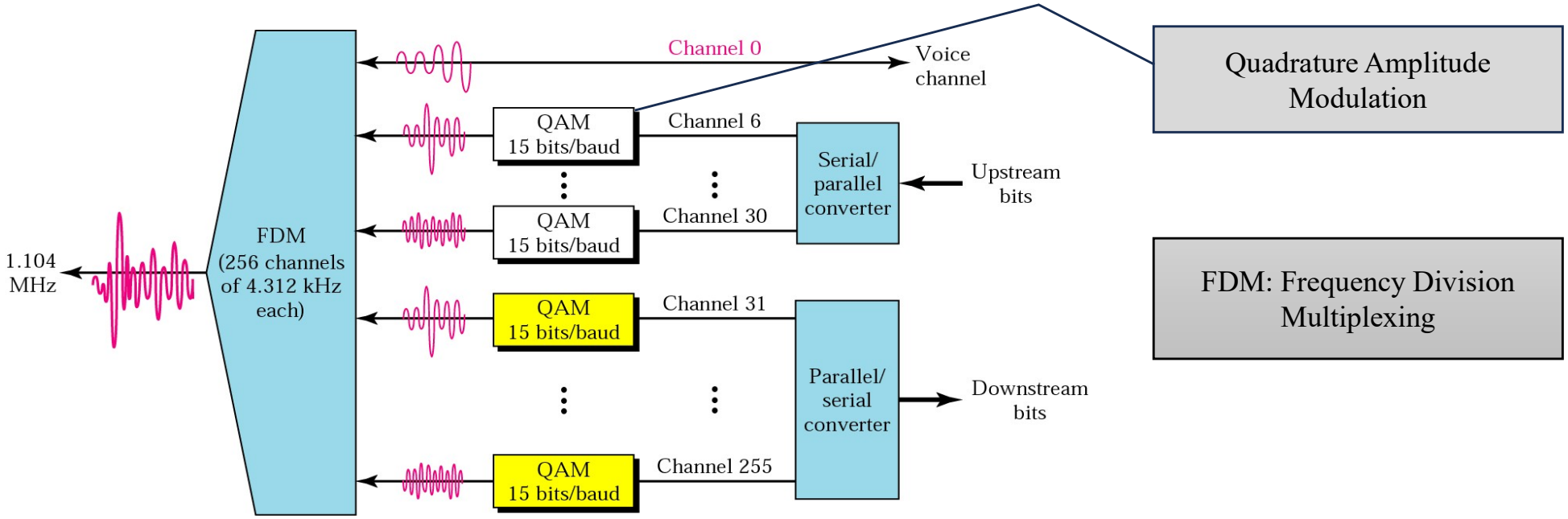


Figure 5: *Modulation Technique*

ADSL/DMT

- **Voice:** channel 0 is reserved for voice
- **Idle:** channels 1 to 5 are not used; gap between voice and data communication
- **Upstream data and control:** channels 6 to 30 (25 channels); one channel for control
- **Downstream data and control :** channels 31 to 255(225 channels); 13.4 Mbps; one channel for control

ADSL

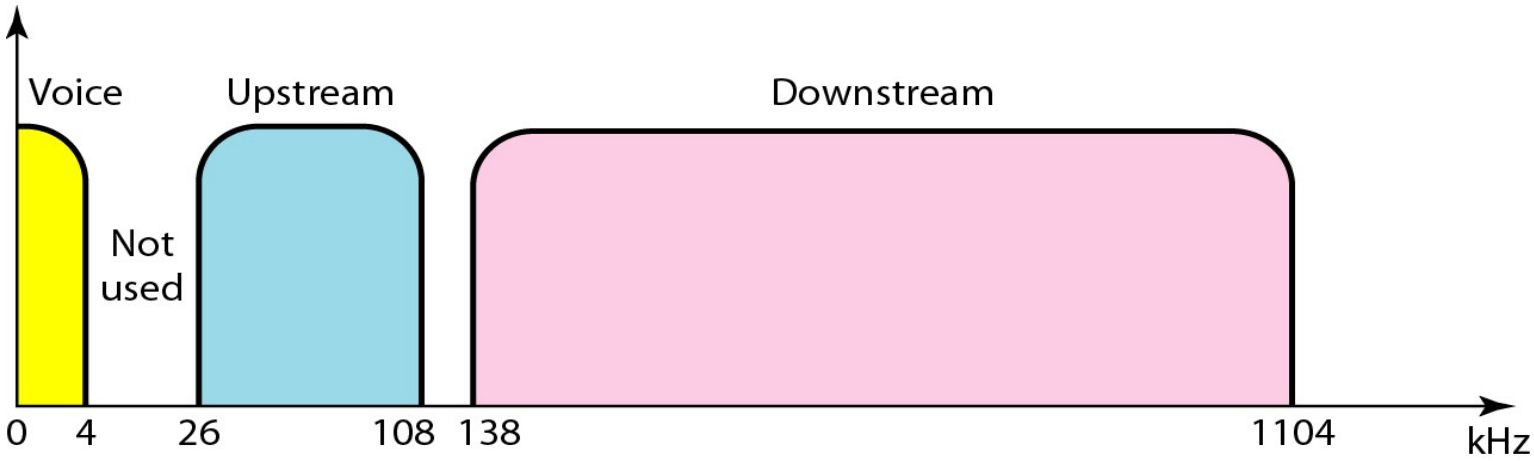


Figure 4: *Bandwidth Division in ADSL*

ADSL

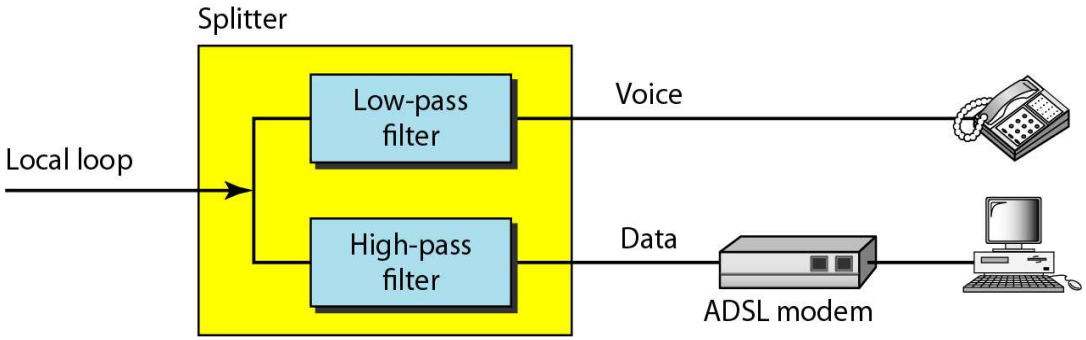


Figure 5: *ADSL modem – customer site*

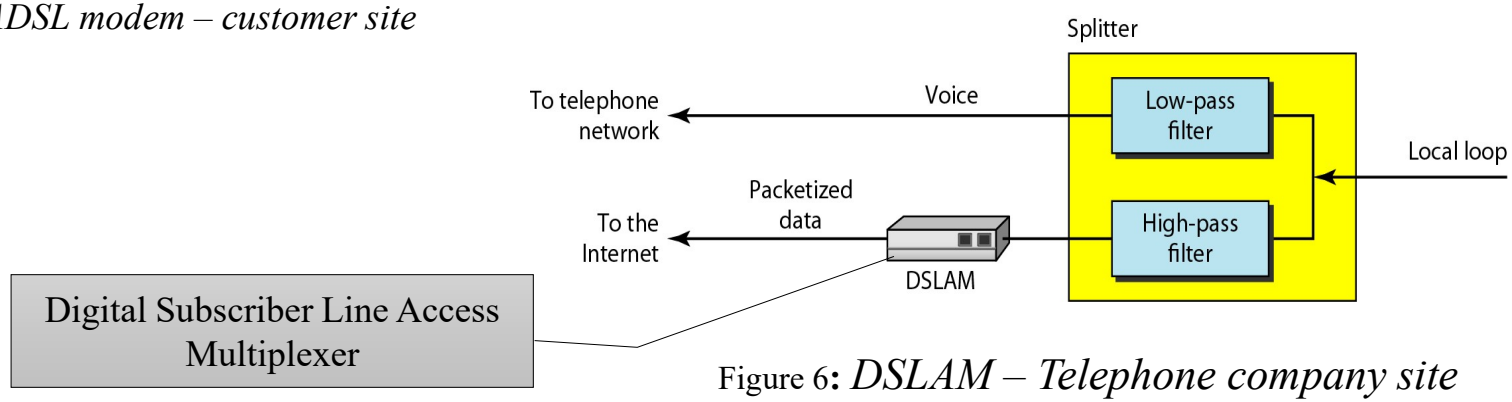


Figure 6**:** *DSLAM – Telephone company site*

Thank You Everyone