Internet Fundamentals

Lecture-9

- Cable Modem
- Data Format

Cable Modems

What are Cable Modems?

- The cable TV plant dedicates a standard cable TV channel to data transfer for Internet and multimedia services.
- A computer equipped with a cable modem is then connected to the cable TV network using the same type of hook-up used for a television.
- Once connected, the cable modem tunes to the channel set aside for data transfer to access the Internet and other multimedia services offered by the cable TV operator.

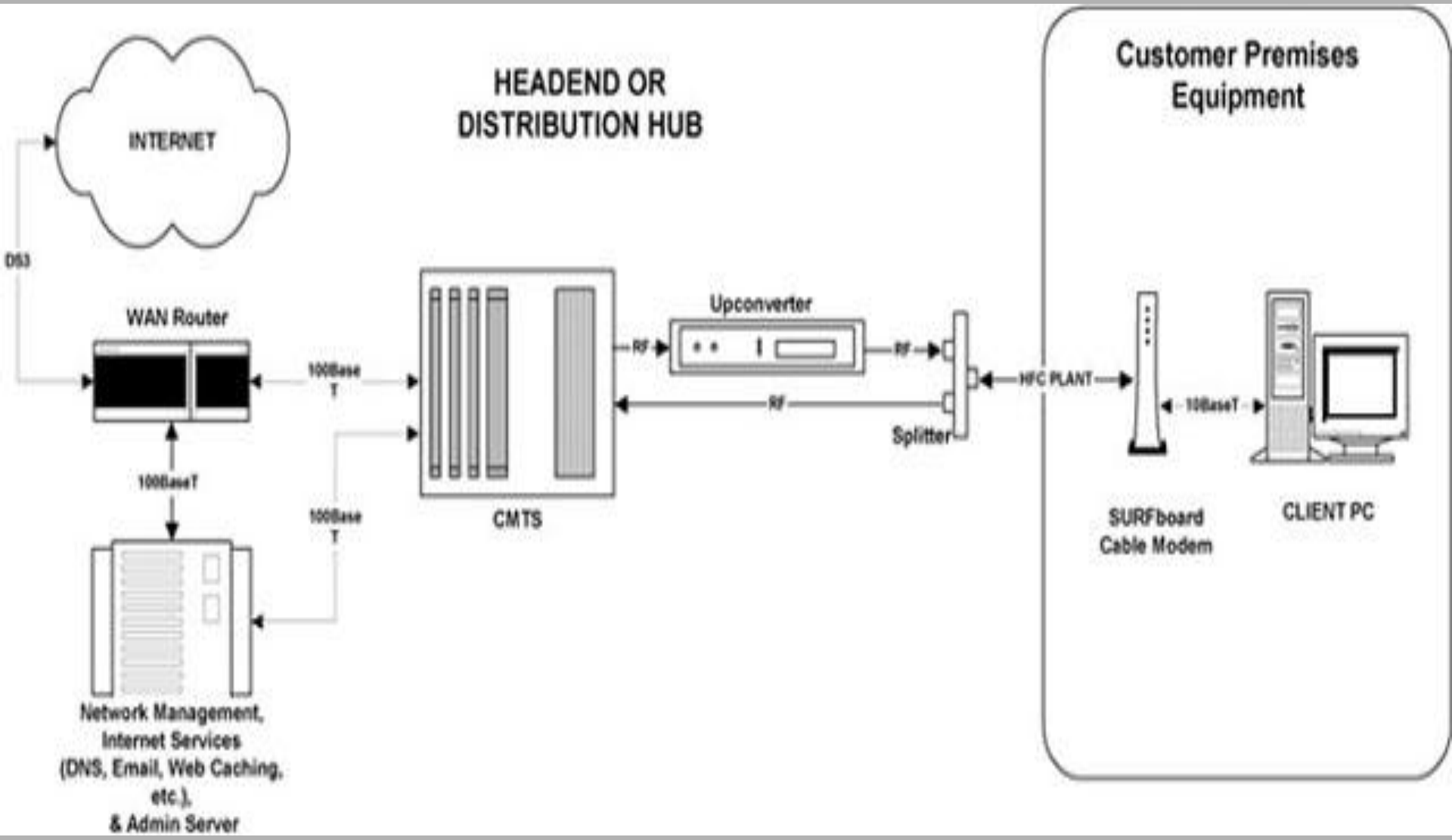
How Fast are Cable Modems?

- Phone Modem connection is about 50 kbit/s and is used point-to-point.
- EtherNet (LAN) connection is 10 Mbit/s or 100Mbit/s and is used to connect many computers that can “talk” directly to each other.
- Cable Modem connection is something in between. Speed is typically 3-50 Mbit/s and the distance can be 100 km or more.

How Do Cable Modems Work?

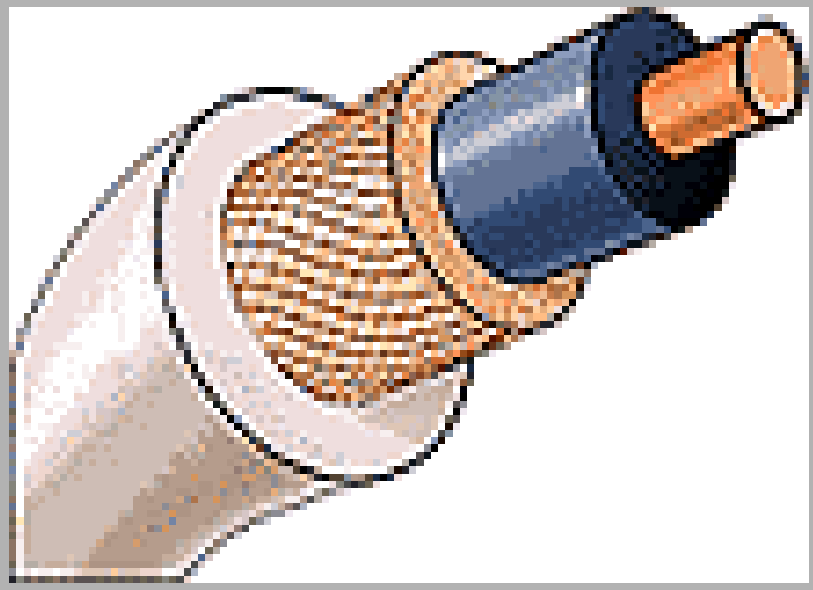
- Cable modems receive digital information carried over the cable TV network and passes it through to the computer via a standard 10BaseT Ethernet interface.
- The Cable Modem Termination System (**CMTS**) can talk to all the Cable Modems, but the Cable Modems can only talk to the CMTS.

Cable Modem Connection



Terminology Continued:

- **HFC** Hybrid Fiber-coaxial (Cable network)
- Modern systems use fiber transport from the headend to an optical node located in the neighborhood to reduce system noise.



Terminology Continued:

- **Downstream frequency:** The frequency used for transmitting data from the CMTS to the cable modem.
- **Upstream frequency:** The frequency used to transmit the data from the CM to the CMTS.

Terminology Continued:

- **QAM:** Quadrature Amplitude Modulation. A method of modulation digital signals using both amplitude and phase coding.
- **QPSK**: Quadrature Phase-Shift Keying. A method of modulating digital signals using four phase states to code two digital bits per phase shift.

What is Downstream?

- What the Cable Modem Receives
- Frequency 65-850 MHz
- Bandwidth 6MHz (USA) or 8 MHz (EU)
- Modulation 64-QAM (or 256-QAM)
- Data-rate 27-56 Mbit/s (4-7 Mbyte/s)
- Continuous stream of data
- Received by all modems

What is Upstream?

- What the Cable Modem transmits
- Frequency 5-65 MHz (5-42 MHz)
- Bandwidth QPSK or 16-QAM
- Data-rate eg 3 Mbit/s (~400 KB/s)
- Transmit bursts of data in timeslots (TDM)
- Reserved and contention timeslots

Downstream Data Format

- Reed-Solomon error Correction
- Corrects 6 errors in 204 bytes
- MPEG-TS (Transport Stream)
- MPEG-PS (Program Stream)
- MAC messages
- ATM cells
- Data addressed to one, many or all Cable Modems

Upstream Data Format

- Reed-Solomon error Correction
- Prepended unique word
- One ATM cell per burst (DVB/DAVIC)
- MAC message or data as payload
- 18 time-slots per ms
- Reserved time-slots for longer data
- Contention time-slots for small data (initiate)

What are the Standards?

- Proprietary systems (1st generation)
- MCNS (USA mainly). Developed for Cable Modem only. Specifies external Cable Modem only, but may add internal.
- DAVIC.DVB (Europe mainly) Used for set-top box and now also Cable Modem.
- IEEE 802.14 lost 1st round, but tries to leapfrog and be the standard of the future (3rd generation systems).

Why is this so cool?

- **Speed Speed Speed**
- Analog modem speed x100 to x 1000
- ISDN speed x25 to x500
- Comparable to T1/E1 or better (~2Mbit/s)
- Surf while you listen to high quality Real Audio

- **On-line full-time**
- Who wants to be a part-time geek, when you can be full-time?
- No dial-up
- Get e-mail instantly
- Run you own web-server
- Game when you want

Cable Modem

- The actual bandwidth for Internet service over a cable TV line is up to 27 Mbps on the download path to the subscriber with about 2.5 Mbps of bandwidth for interactive responses in the other direction.
  $39.95 - $44.95*
- * Pricing is for residential service and varies by market. May be higher if you are not a cable TV subscriber.