

Announcements

- Reading
 - Chapter 5: 5.1-5.4
- Suggested Problems
 - 3,4,5,14,35, 46, 47, 49, 50

Transmission Media (cont.)

- Coax

- copper with an insulator between it
 - 75 ohm - common for T.V.
 - 50 ohm - common for data transmission
- rates: 10's of Mbps baseband, 100's Mbps broadband
- supports multiple drops

- Fiber

- uses principal of total internal reflection
 - get light to “bounce” along the fiber
- point to point communication
- 100's Mbps to several Gbps

Transmission: No Cables

- Microwave

- above 100MHz
- uses directional (parabolic antenna)
- with 100m towers, can space them every 80km
- security:
 - directional signal
 - can add hop-by-encryption

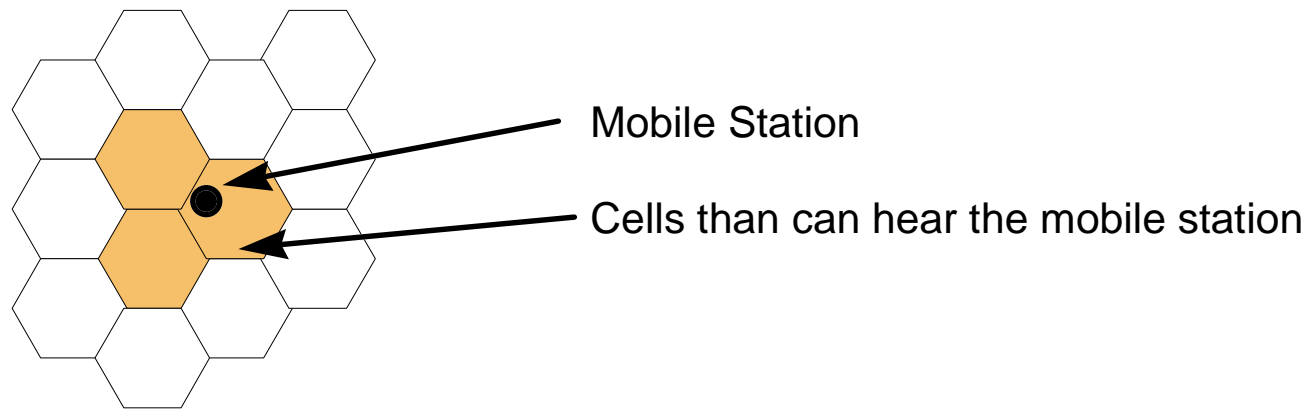
- Infrared

- uses: television remote, computer TANs (Table Area Nets)
- signal will not pass through walls
- security:
 - signal confined to a single room
 - anyone in the room can hear the signal though

Transmission: No Cables (cont.)

- Cellular Radio (AMPS)

- divide service areas into cells
 - each unit talks to a base station in the cell
 - 832 duplex channels (allocated to two providers)
- security
 - virtually none
 - easy to eavesdrop
 - ease to “clone” cell phones



Transmission: Satellites

- **Different Orbits Possible**
 - orbit affects many communication properties
- **Geosynchronous**
 - always over the same spot on the earth
 - 36,000 Km orbit is required
 - only 180 slots possible
 - uses one uplink and one down link frequency
 - large round-trip latencies
- **LEO (Low Earth Orbit)**
 - each satellite keeps moving into and out of range
 - solution: use a large number of satellites
 - sort of like cells, but the cells are the ones moving
 - lower round-trip latency

Sending More Than one Signal At Once

- Called multiplexing
 - original goal of Bell was to MUX multiple telegraph signals
- Time Division Multiplexing
 - everyone gets whole bandwidth
 - but only when its their turn

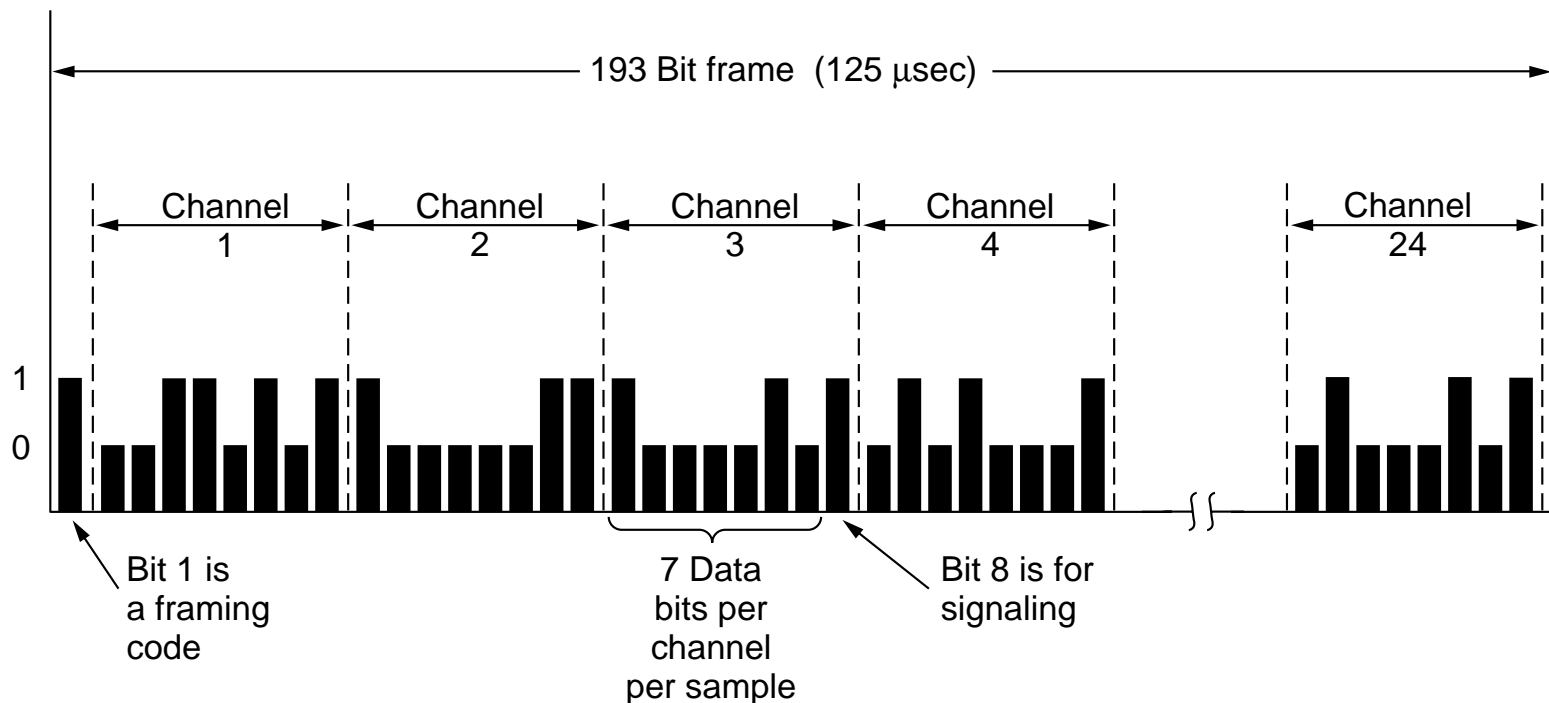


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Frequency Division Multiplexing

- Frequency Division

- everyone gets to talk at once
- but only in their own frequency

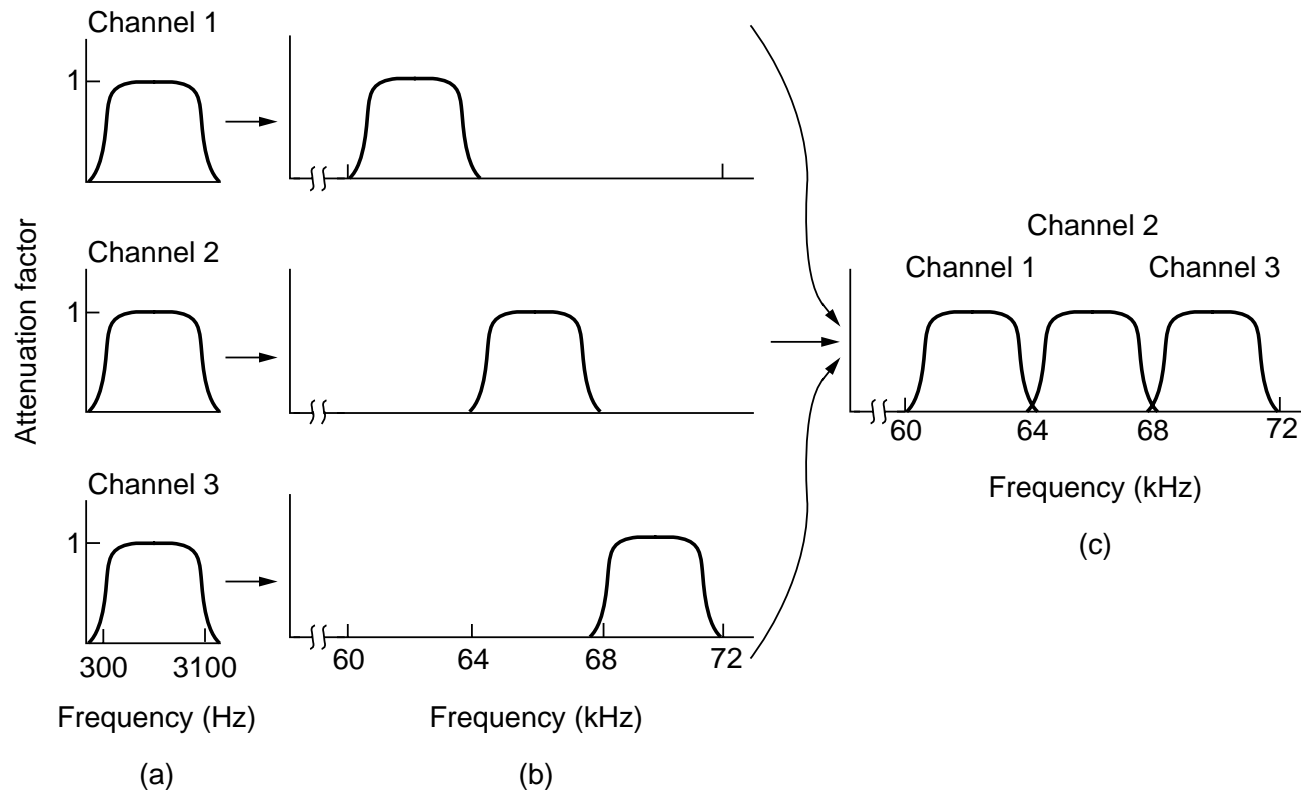


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ATM Switching

- Requirements

- be able to switch 360,000 cells/sec per input link
- switch cells with as low a discard rate as possible
- never reorder the cells on a virtual circuit

- Issues

- multiple cells destined for the same output at once
 - need to buffer one of them
 - must ensure fairness is maintained
- head-of-line blocking
 - possible that a blocked output is holding up cells that could be delivered