Types of Networks for Multimedia

- **Cable Network**
  - Can support video due to relatively high bandwidth
  - Downstream is provided via a broadcast mechanism
  - No individual address and no switches/routers in a cable network
  - Upstream bandwidth is low

- **Telephone Network**
  - Individual addresses, routing, and switching
  - Circuit switched (see main lecture notes)
  - Relatively low bandwidth

- **Data Networks**
  - Packet switched (lower $\$ cost)
  - The Internet is an example of a data network

Network Performance Measures

- **Bandwidth** – how much data can be transmitted across a network in one second
- **Delay** – how long it takes a packet to reach a receiver after a sender transmits it
- **Jitter** – variation in delay

Classes of Performance

- **Best Effort** – No guarantees are made on performance, the network makes a “best effort” to deliver the packets quickly and reliably.
- **Deterministic** – Guarantees are made on performance (bandwidth and delay), and the network ensures that each user gets the same performance at all times regardless of the amount of traffic.
- **Statistical** – a deterministic network where guarantees are made within a certain range of performance (a statistical network that guarantees 100% of the promised performance is a deterministic network).
Example of Network Guarantees with Multimedia Streams

Given two MPEG video streams:

Stream 1:

Stream 2:

Traffic Patterns

The average bandwidth for the above diagram is 1.2Mbps.

**Deterministic Network:** Guarantees full bandwidth at all times. So, a deterministic network will require **10 Mbps** for this example since stream 1 and stream 2 both use 5 Mbps of bandwidth simultaneously.

**Best Effort:** For this example, we’ll say that each stream receives the average bandwidth that it uses. So, streams 1 and 2 each can receive 1.2Mbps simultaneously for a total network capacity of 2.4Mbps. Best effort network make no guarantees against loss, and since the traffic amount from 0.95s to 1.0s is 10Mbps total, some packet loss occurs. The total amount lost is (10Mbps-2.4Mbps) * 0.05s. Which is 7.6Mbps * 0.05s = 0.38Mbits in one second.

This equates to a \( \frac{0.38}{1.2} \times 100\% = 31.7\% \) total loss per second, or a loss of 15.85% per stream.