



SMU | BOBBY B. LYLE
SCHOOL OF ENGINEERING

SMU Course #: EETS 7315

DATA COMMUNICATIONS

Week #15 -- Dr. Baker

High-Speed Digital Services

Connectionless vs. Connection-oriented Protocol Operation

- Connectionless protocol operation implies no "handshake." Data frames are sent "in the blind" with no accountability mechanism. Errored frames are discarded without response.
- Connection-oriented protocol operation implies a "handshake," the numbering of frames, and automatic retransmission and accountability, all under control of protocols. (Errored frames still discarded.)

Definitions: Reliable Vs. Unreliable Services

- A Reliable service checks all data messages for proper sequencing and transmission errors, retransmitting if necessary, before delivery to the destination terminal.
- An Unreliable service may or may not deliver messages containing transmission errors. Software/hardware in terminals must be used to control sequencing and errors.

Review: High-Layer Functions

- HLFs are functions provided by Layers 4-7 in the OSI Reference Model
- Only End Systems are permitted to have protocols that operate in the High Layers
- Therefore, all Uppers Layers must be the same — connection-oriented or connectionless.

Definitions: Real Vs. Virtual Circuits

- A Real digital circuit is one for which the destination(s) of all bits from a given input point is always the same for the duration of the connection. Example: a digital phone call.
- A Virtual digital circuit is one for which the destination of bits from a given input point is controlled by overhead (header) bits. Many virtual circuits may terminate at the same physical point at the same time. Example: e-mail.

Modes of Operation in Virtual Data Networks

- PVC (Permanent Virtual Circuit) - All terminals that will be communicating with each other must be provisioned. Route of traffic along PVC tends to be constant.*
- SVC (Switched Virtual Circuit) - Any terminal can call any other. Once SVC is established, it acts like a PVC until cleared.*
- Datagram - Neither PVC nor SVC. Each datagram travels independently through network. * Abbreviated addressing

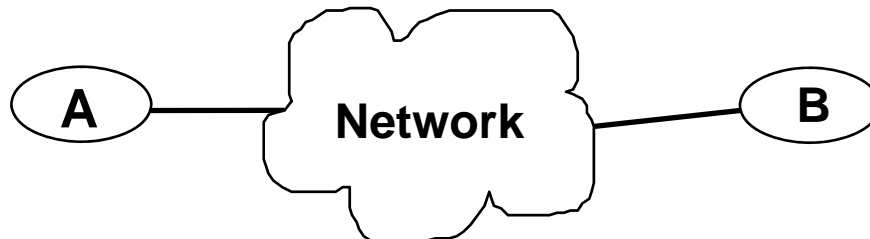
Definitions: Public Vs. Private Networks

- A public network is one that is available for use by the general public.
- A private network is one that is available for use by specific people or terminals. It may be provided by a public carrier or through private ownership or a third party; that is irrelevant.

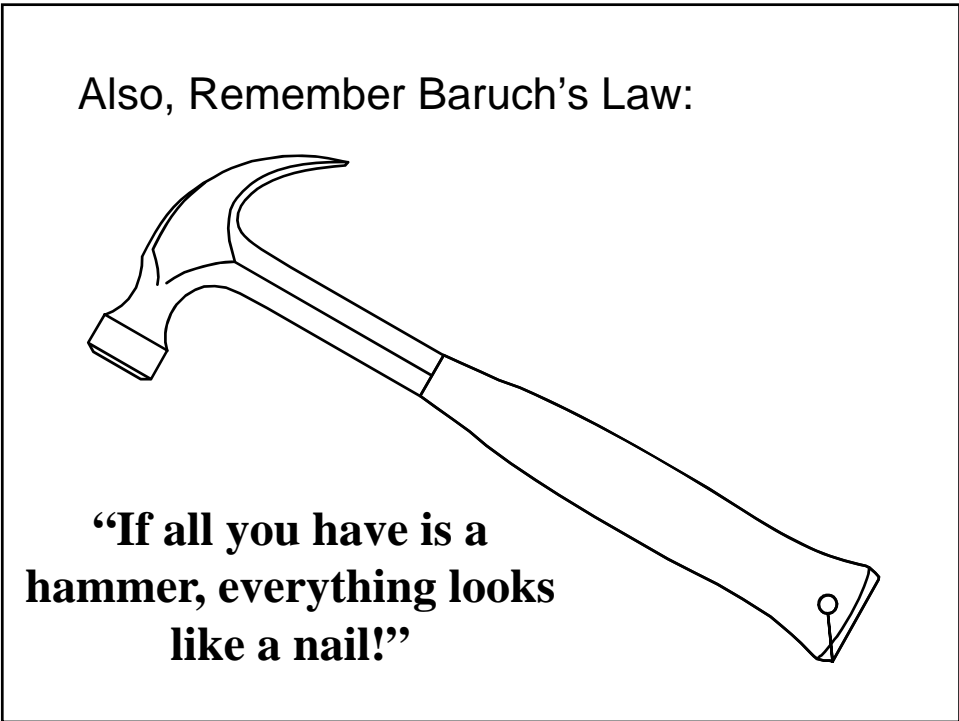
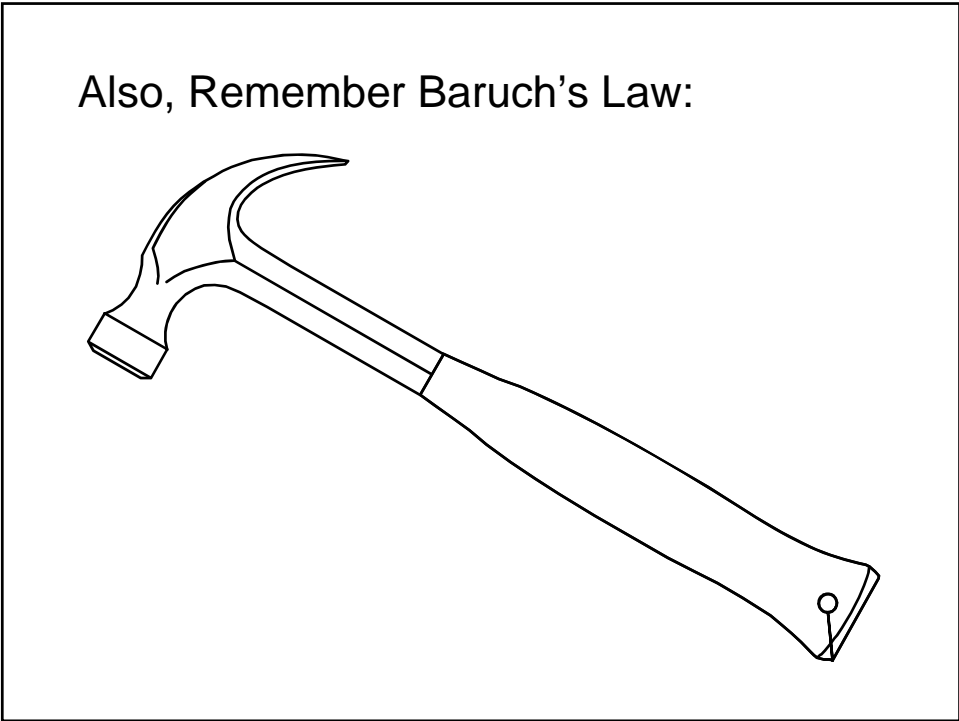
Definitions: Delays

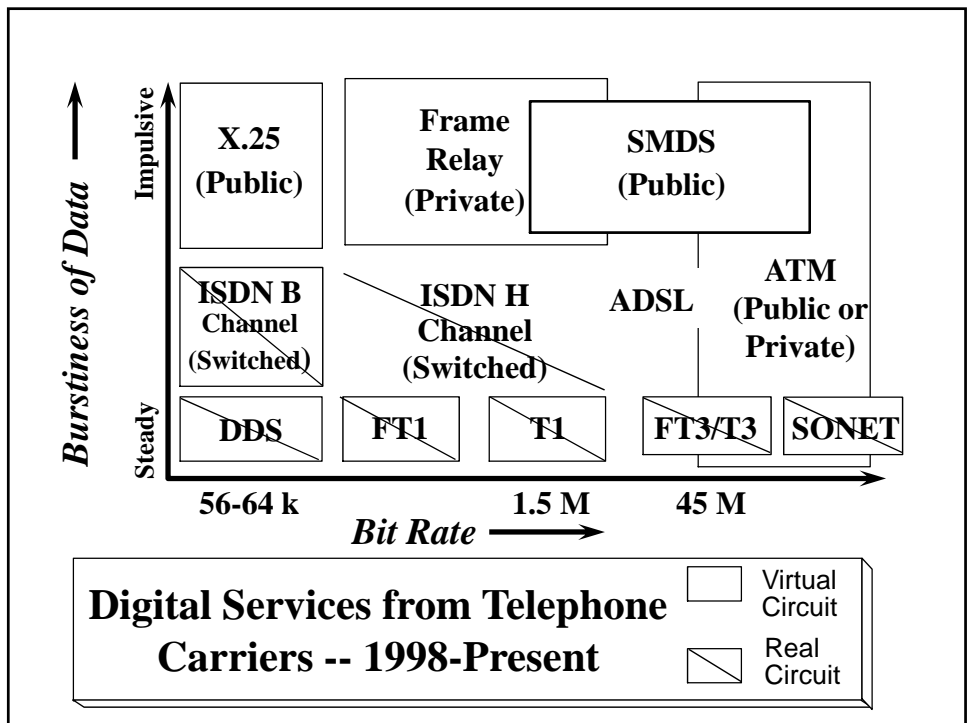
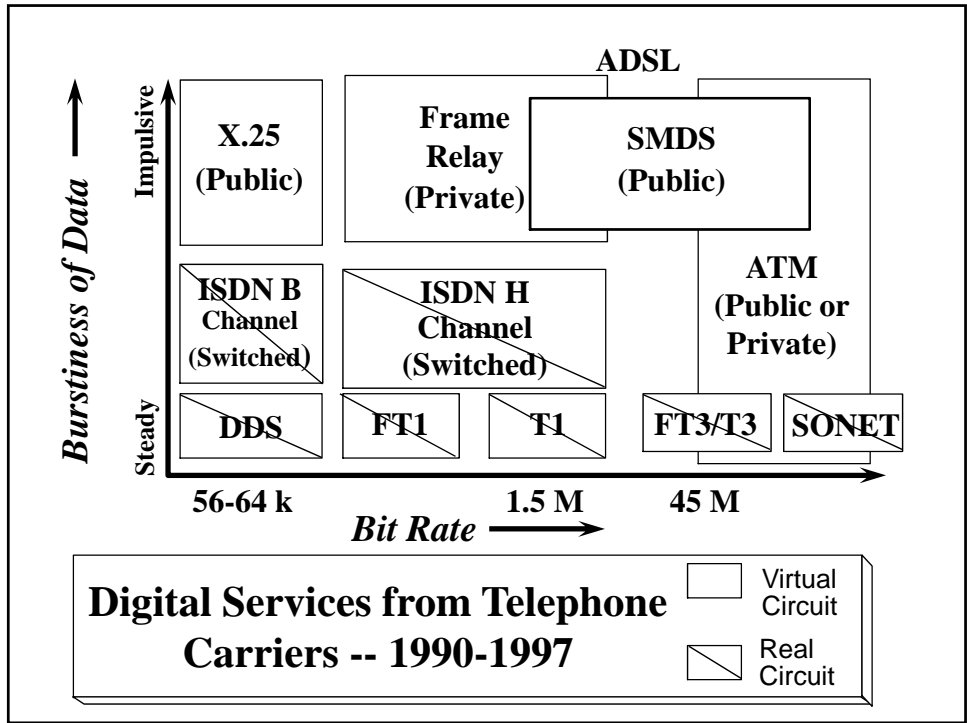
- **Network Latency:** The time it takes for a message to get through the network, from when the last bit of a message has entered until the first bit leaves the network.
- **Transit Delay:** The time it takes a message to get from TE to TE, from when the first bit leaves sending TE until last bit enters receiving TE. (Latency + Propagation and Transmission Delays in Access Lines)

Beware the Slow Access Line



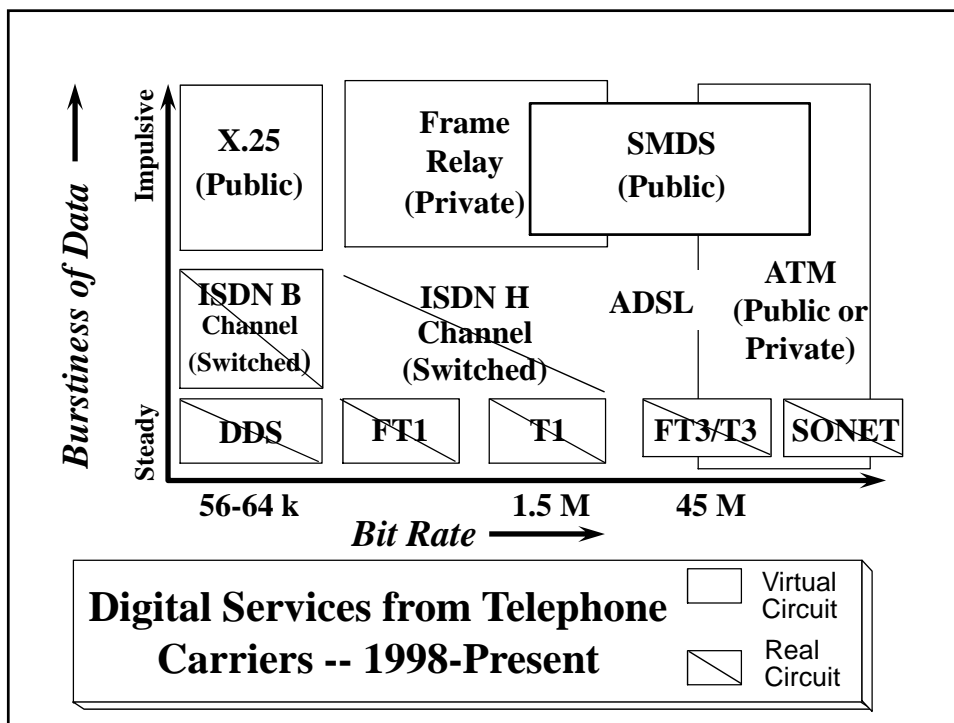
- Access Line Transmission Delay = No. of Bits divided by Bit Rate.
- Propagation Delay = Buffer delays + 1 millisecond per 150 miles.





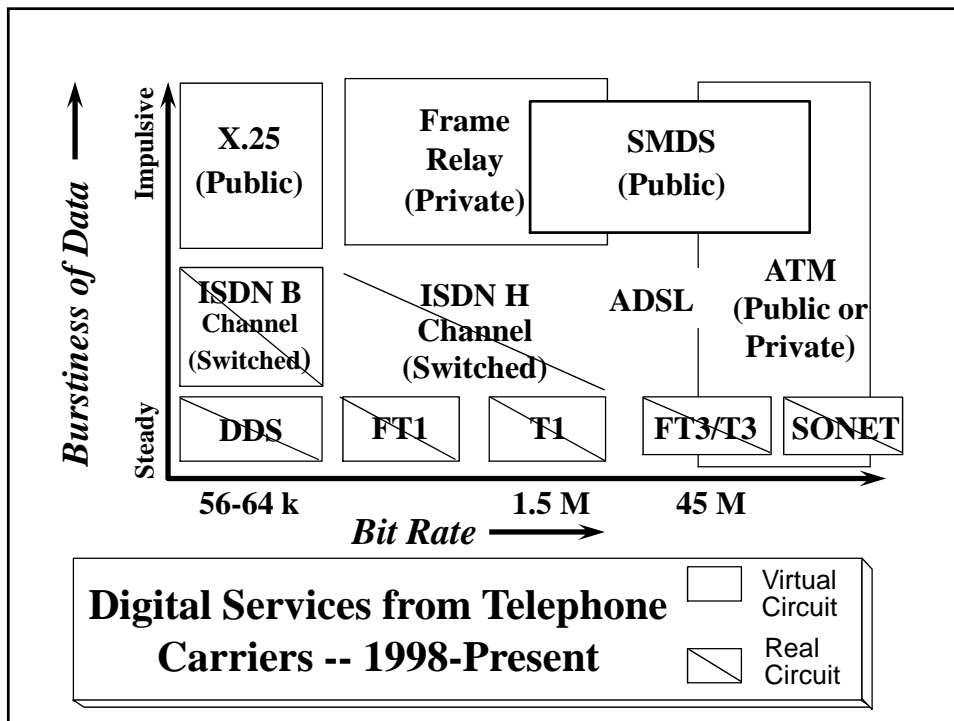
Bottom Row of Chart

- All of these are real digital private line services, minimal transit delay
- Full-time availability
- Unreliable - Frames will be delivered with or without errors. It is the responsibility of the user to check for and correct bit and sequence errors.
- Well-suited for fairly continuous data streams.



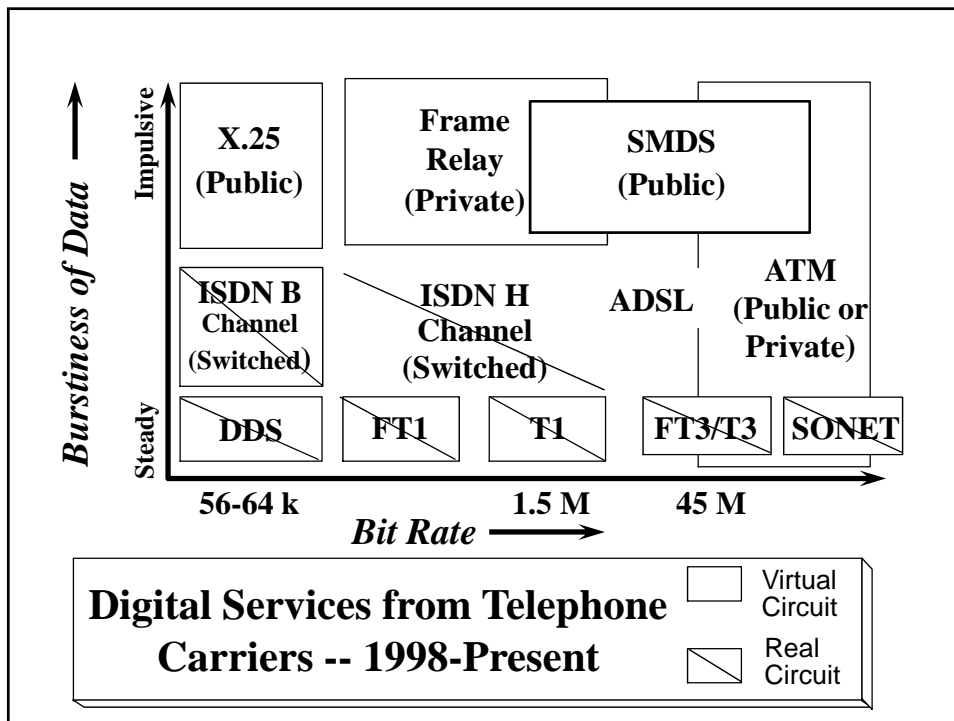
FT1 (Fractional T1)

- Multiples of 64 kb/s (sometimes limited to 1, 2, 3, 4, 6, 8, or 12 times 64).
- 64 kb/s is generally much cheaper than 56 kb/s DDS, but significantly less likely to be available in suburban and fringe areas.



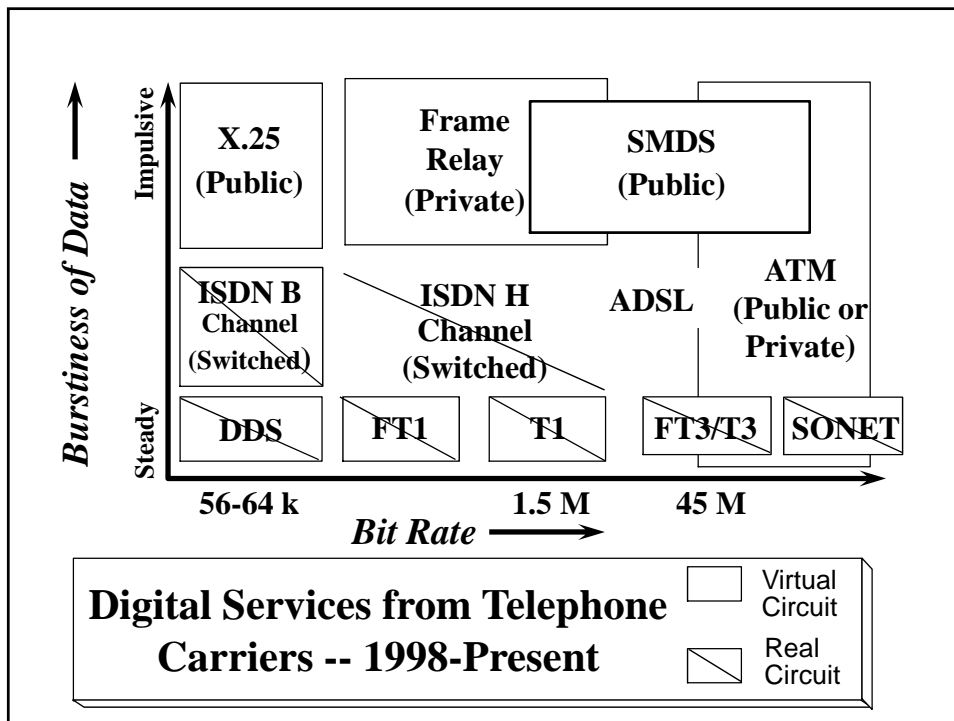
ISDN Switched Services

- These are real digital switched-line services
- Requires 1-second cut-through delay for set-up. Minimum transit delay
- Unreliable - Frames will be delivered with or without errors. It is the responsibility of the user to check for and correct bit and sequence errors
- Well-suited for fairly continuous data streams during periods throughout the day; excellent for augmenting private lines during data busy-hours



X.25 Services

- Worldwide availability; ubiquitous in the U.S.; being a public network, any terminal can call (SVC) or provision a PVC with any other.
- Reliable built-in error and sequence control; automatic reroute in case of network failure
- Small maximum packet size (128-256 bytes) makes it ideal for transaction processing; less practical for large files.
- Longer transit delay than Frame Relay.
- Also available packaged with ISDN services.

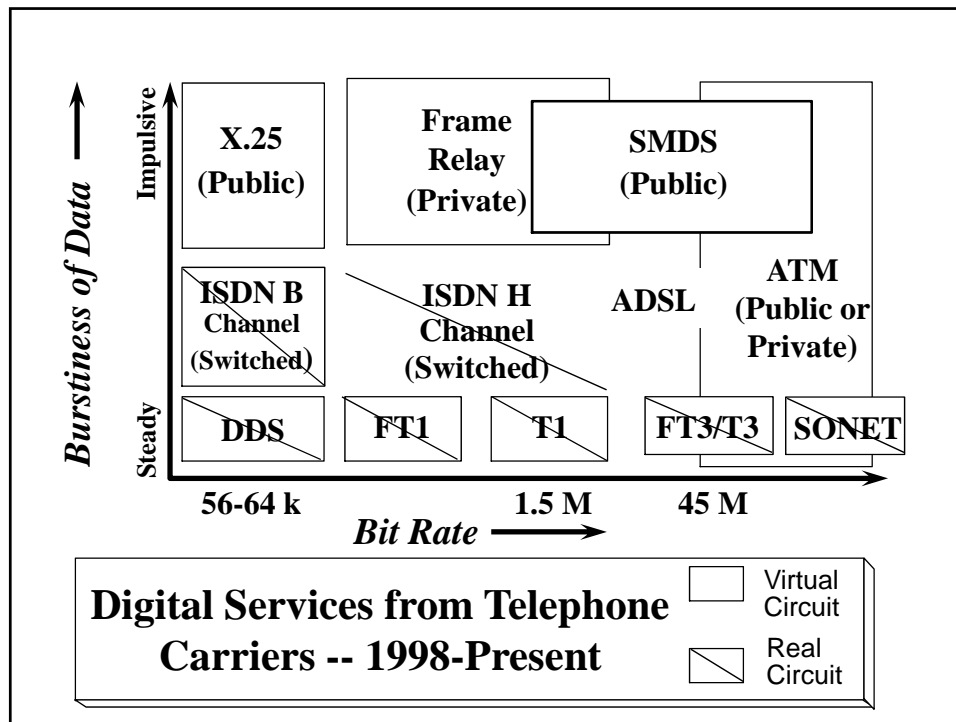


Frame Relay Services

- Available in many areas of the world and internationally (PVC only). Since all communicating partners must be specified at network provisioning time, it is a private network.
- Unreliable; TE responsible for controlling bit and sequence errors. Errored frames discarded.
- Frame sizes can be up to 1500-4000 bytes, depending on tariff.
- Short transit delay makes it ideal for long bursty files, but beware of slow access lines.

Frame Relay CIR (Committed Information Rate)

- CIR can be any tariffed rate from 0 to access line speed; lower CIRs are cheaper.
- If the average user transmission rate over a specified period exceeds the CIR, then frames are marked "Discard Eligible."
- If switch congested, DE frames are discarded.
- If no DE frames, carrier makes "best effort" to deliver frames during congestion period (typically 95+% probability of delivery).



SMDS - (Switched Multimegabit Data Service)

- A public datagram network.
- Each datagram can be up to 9000 bytes.
- Each datagram contains the entire address of its destination.
- Address filtering is optionally available for incoming traffic; limits viruses and junk mail.
- Less availability due to carriers being unwilling to offer it. (A threat to more profitable services)
- Unreliable.

