SMU Course #: EETS 7315

DATA COMMUNICATIONS

Week #8 -- Dr. Baker

New Topic:

Frame Relay Architecture

Outline

- Definition
- Growth
- Characteristics
- Standards
- Implementations
- Applications

Definition

- Frame relay is an efficient network interface standard that gets its name from its method of operation – the relaying of frames of information through a network.

Frame Relay Terms And Definitions

User to Network Interface (UNI)

- Specifies signaling and management functions between a frame relay network device and the end user's device

Network to Network Interface (NNI)

- Specifies signaling and management functions between two frame relay networks

More Frame Relay Terms And Definitions

Virtual Circuit (VC)

- The connection between two frame relay ports

Permanent Virtual Circuit (PVC)

- A pre-defined VC

Switched Virtual Circuit (SVC)

- A VC that is established dynamically

Introduction to Frame Relay

- A Layer 2 extension of switching multiplexer technology
- Provides only PVC service with fixed routing
- Maximum of 992 f.r. network destinations can be addressed per port. Sometimes less.
- No provision for retransmission of errored or missing frames, so a reliable Layer 3/4 system is needed

Characteristics of Frame Relay Carrier Services

- Establishes a virtual circuit (Currently, only permanent virtual circuits are supported.)
- Assumes a relatively error-free transmission environment
- Checks for, but does not correct, transmission errors
- Relays frames from a given network interface to up to (typically) 992 destinations through the network

Frame Relay Uses Virtual Circuits

- Real circuits: The destination(s) of all bits from a given input point is always the same for the duration of the connection. Example: a phone call.
- Virtual circuits: The destination(s) of bits from a given input point is controlled by header bits in the frame. Many virtual circuits may terminate at the same physical point at the same time. Example: WWW.

Frame Relay Checks for Errors

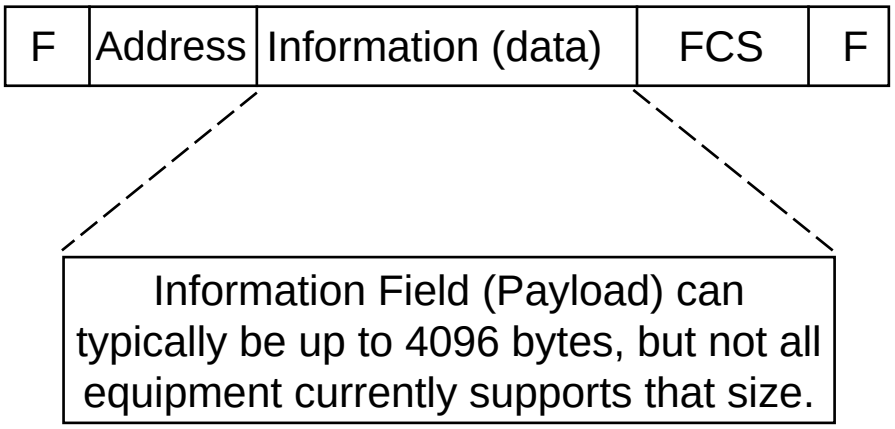
- Each frame is checked for transmission errors at least after it crosses the network interface from/to the user.
- Any frame that contains a transmission error is immediately discarded.
- There is no mechanism for automatic retransmission of discarded frames.
- End-to-end error and flow control, if employed, are done by higher layers.

Standards

- Originally mentioned as a possible "Additional Packet Mode Bearer Service" under Narrowband ISDN in CCITT I.122 in the 1988 Blue Books, the main driving force behind the standards has been the Frame Relay Forum, working through ANSI. Today's standards are mainly embodied in ANSI T1.606, T1.617, & T1.618. In ISDN standards, they are in Q.922 and Q.933.

Frame Relay Frame Layout

Frame Relay Frame Layout



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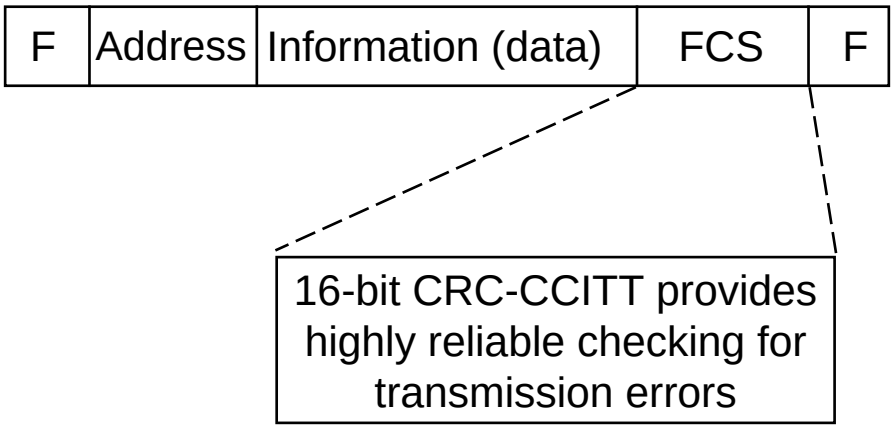

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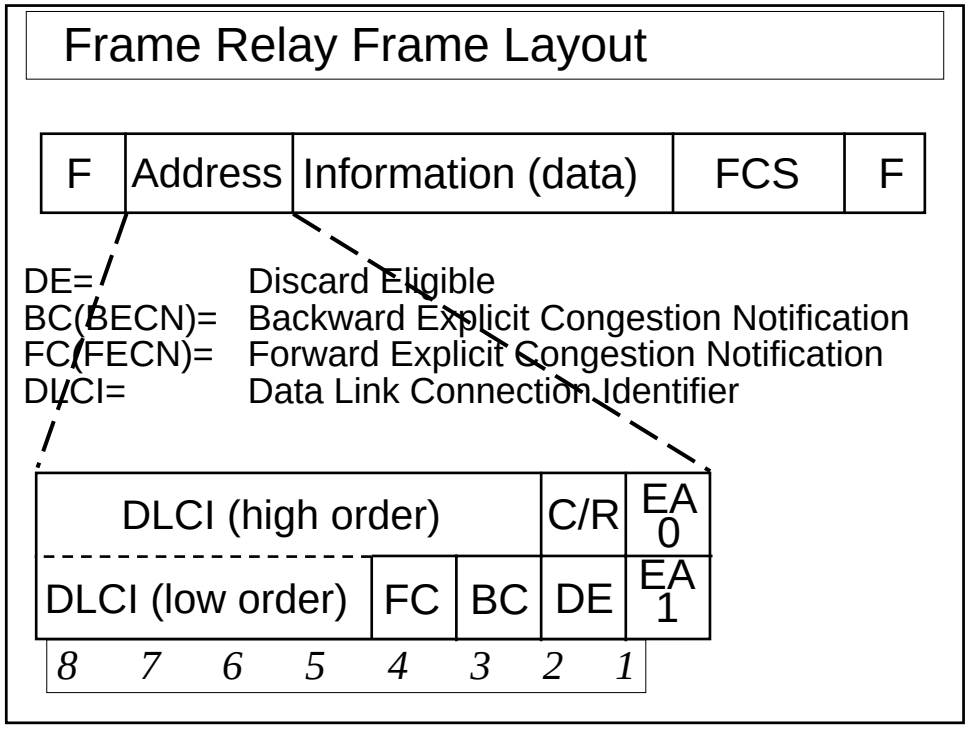
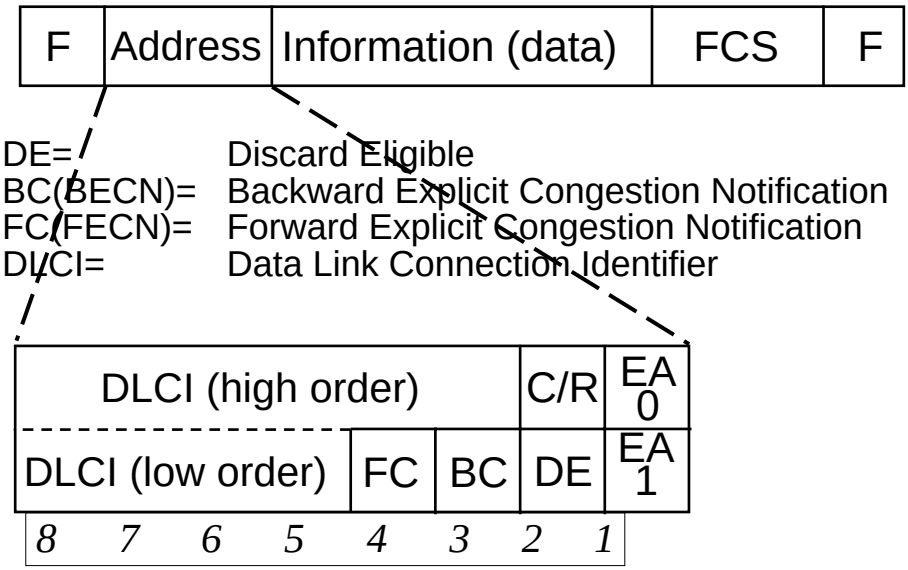


Committed Information Rate (CIR)

- CIR is some maximum payload bit rate to which the customer subscribes
- CIR is always specified as some average over a stated interval
- If the customer exceeds the subscribed CIR, then the FRAD (Frame Relay Access Device) changes the DE bit to 1
- Frames for which DE = 1 are discarded if network congestion occurs

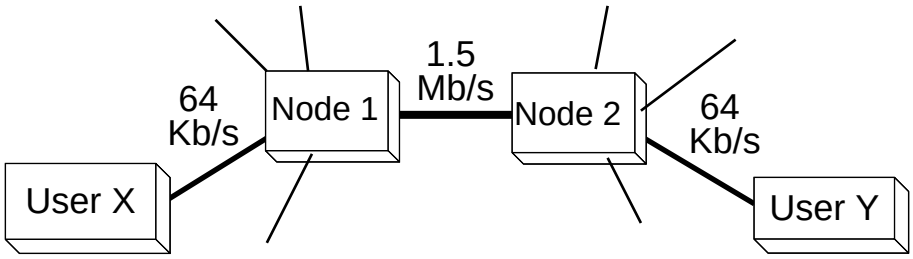
Frame Relay Frame Layout



When analyzing a "service," be sure you understand the technology used in providing that service.

Delays in Packet Systems

Consider a typical 2-node packet system



Delays include: Transmission from X, propagation and buffering in X-1, processing in 1, transmission, propagation and buffer in 1-2, processing in 2, transmission and buffering in 2-Y.

Issues in Selecting a WAN

- Quantity of data
- Transit delay of data
- Accuracy of transmission
- Number of communicating partners
- Reliability and availability of network
- Privacy
- Management capabilities, accountability
- Cost

Quantity of Data

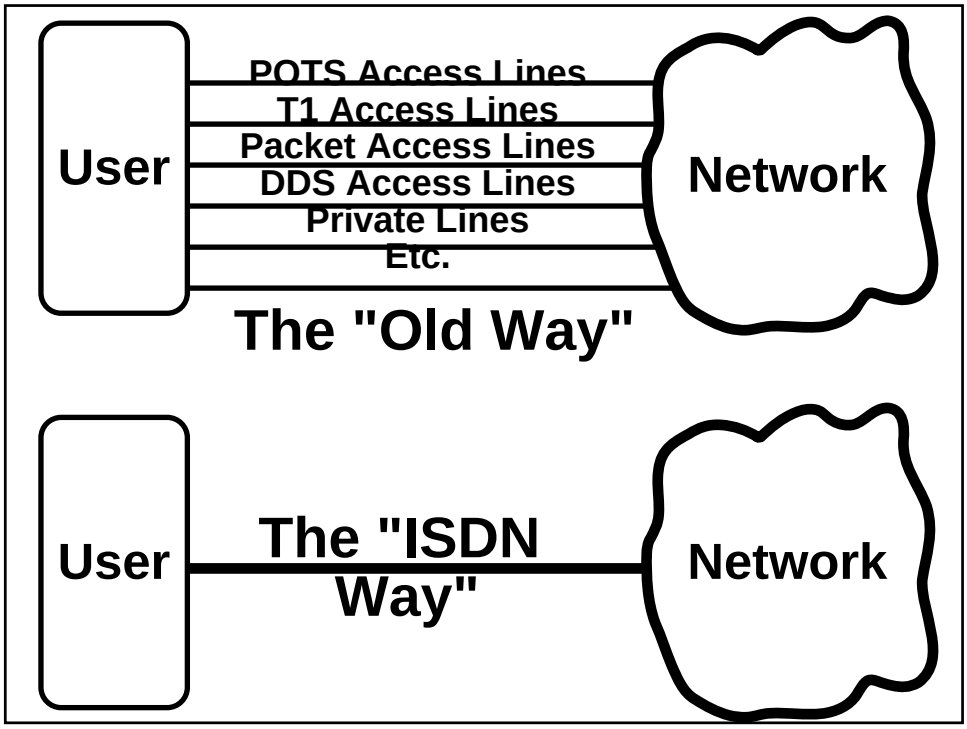
- Actual size of file +
- Overhead bits including start, parity & stop bits, transparency bits, and sync char. +
- Protocol Control Information (PCI), including headers and tailers +
- Acknowledgements and other overhead messages required by protocol +
- Additional bits created because of segmentation of data

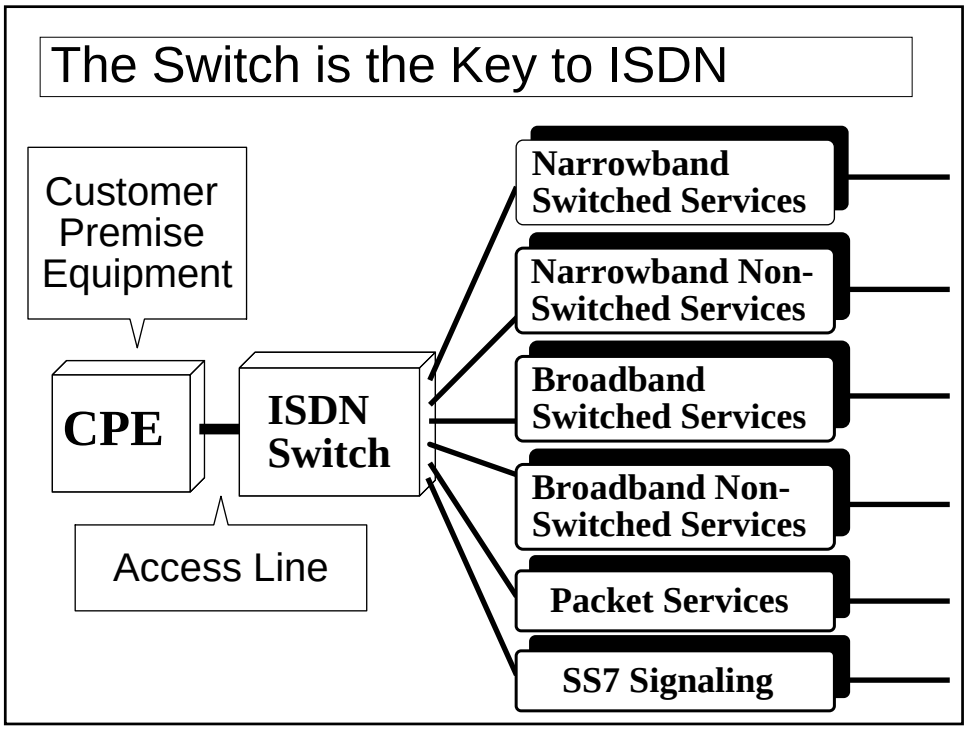
Possible Components of Transit Delay

- Connection Delay -- awaiting cut-through
- Transmission Delay -- bits in frame ÷ burst rate
- Propagation Delay -- related to length of medium
- Modem Delay -- data conversion processing time
- Buffer Delay -- data waiting in buffer; especially for multiplexers, speed changers, gateways
- Window Delay -- protocol requires ack.
- Processing Delay -- data awaiting a routing decision, analysis or header
- Congestion Delay -- too much data

New Topic: ISDN

Integrated Services Digital Networks is an all-digital networking architecture whereby, by using a specific set of standard protocols, all of the services offered by a communications network may be made available to the user via a common access structure.





Classifications of ISDN

- Narrowband ISDN, consisting of services based on data rates up to DS1, for which technology was then available, and which could be implemented in the short term
- Broadband ISDN, consisting of services based on data rates faster than DS1, for which technology would have to be developed

Narrowband ISDN

•An ITU goal is to minimize the number of different access structures. Narrowband has two:

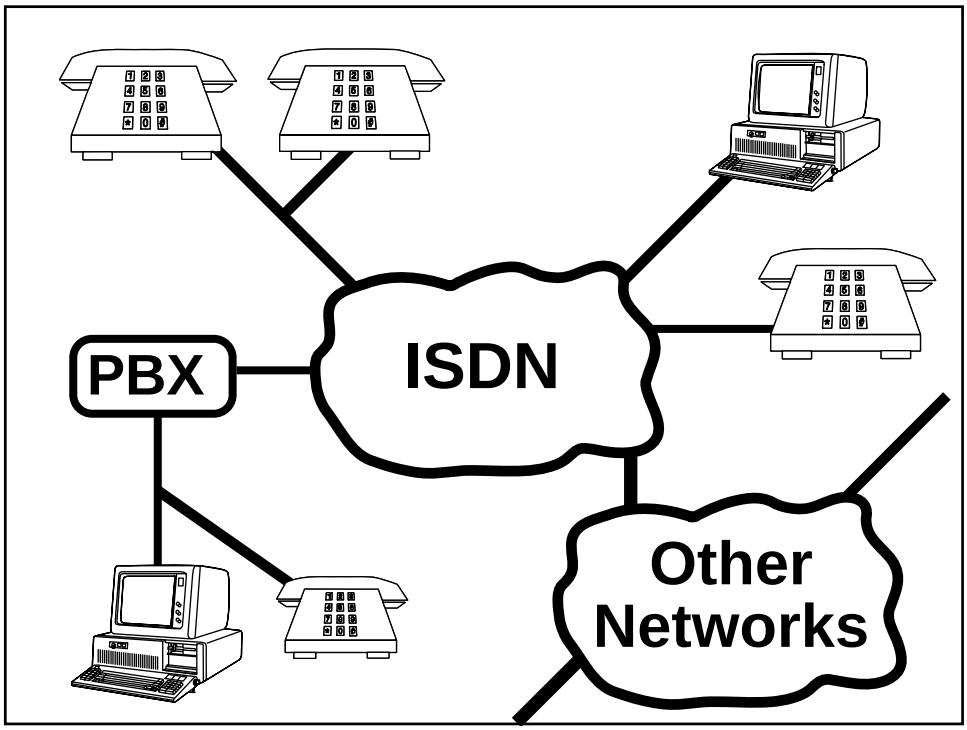
•Basic access structure, based on the ubiquitous twisted copper pair

•Primary access structure, based on the nearly ubiquitous DS1 system

•Generally, services whose bit rate fits into a structure, will be so offered

ISDN Basic Access

- Medium is twisted metallic pair
- Access may be arranged for NB + D, where N = 0, 1, or 2 (2 in U.S.)
- B is always 64 Kb/s
- D in this case is 16 Kb/s

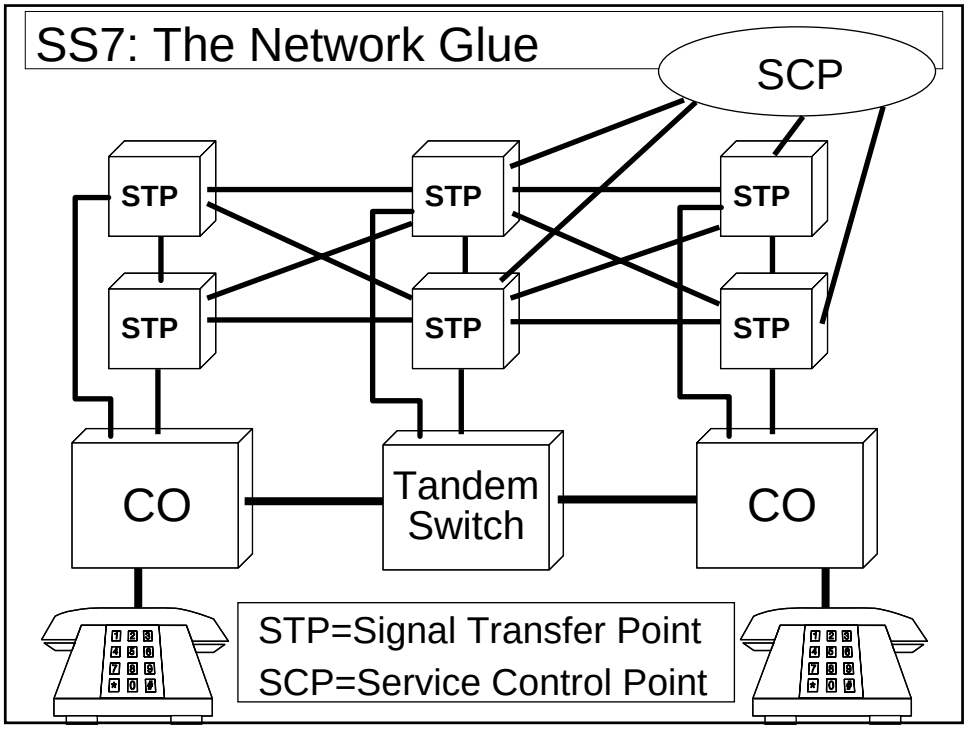


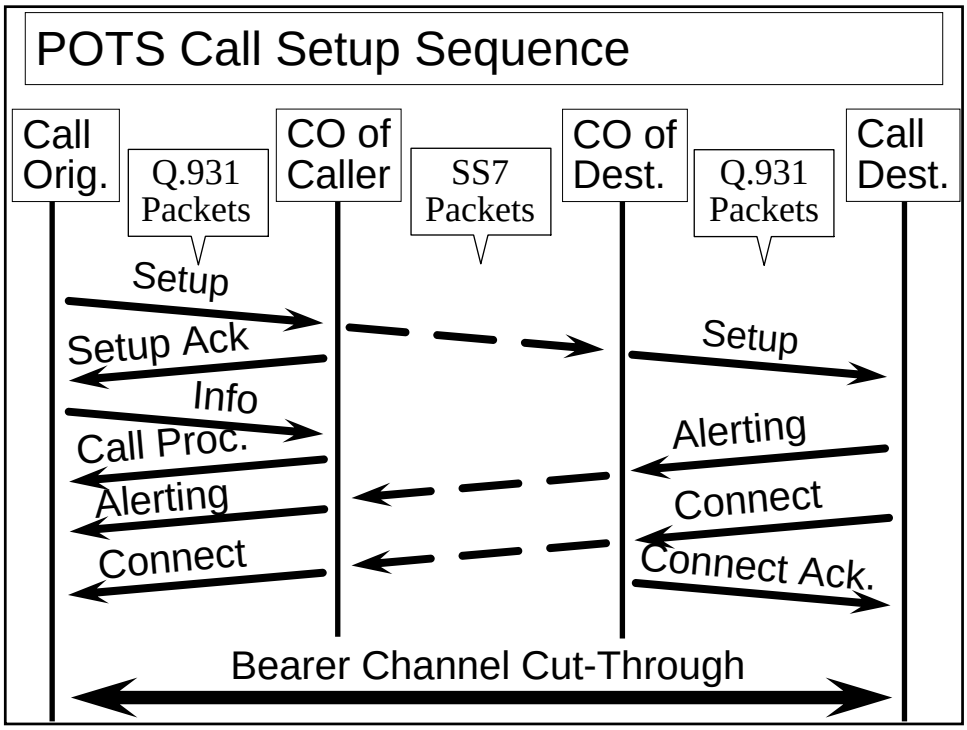
Narrowband ISDN User Channel Mnemonics

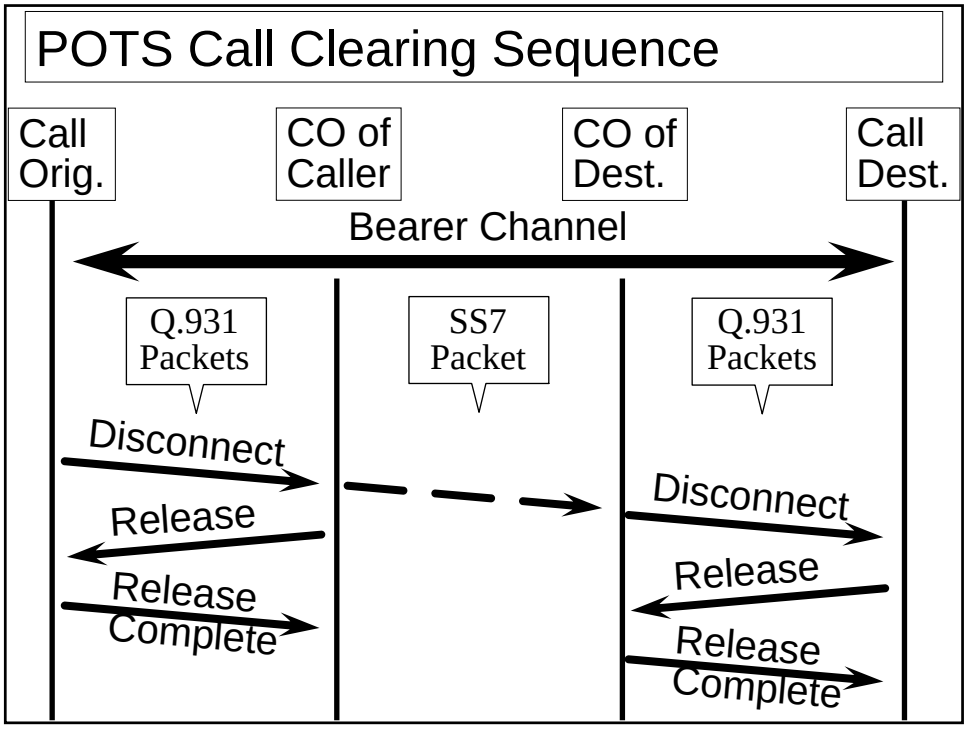
- B = "Bearer." A 64 Kb/s TWS User-to-User channel
- H = "High-Speed Bearer." Same as above, except higher bit rate. H_0 = 384 Kb/s, H_{11} = 1.536 Mb/s, H_{12} = 1.920 Mb/s
- D = "Delta." This channel carries Q.931 packets of command information for requesting changes in a Bearer Service. Also for X.25

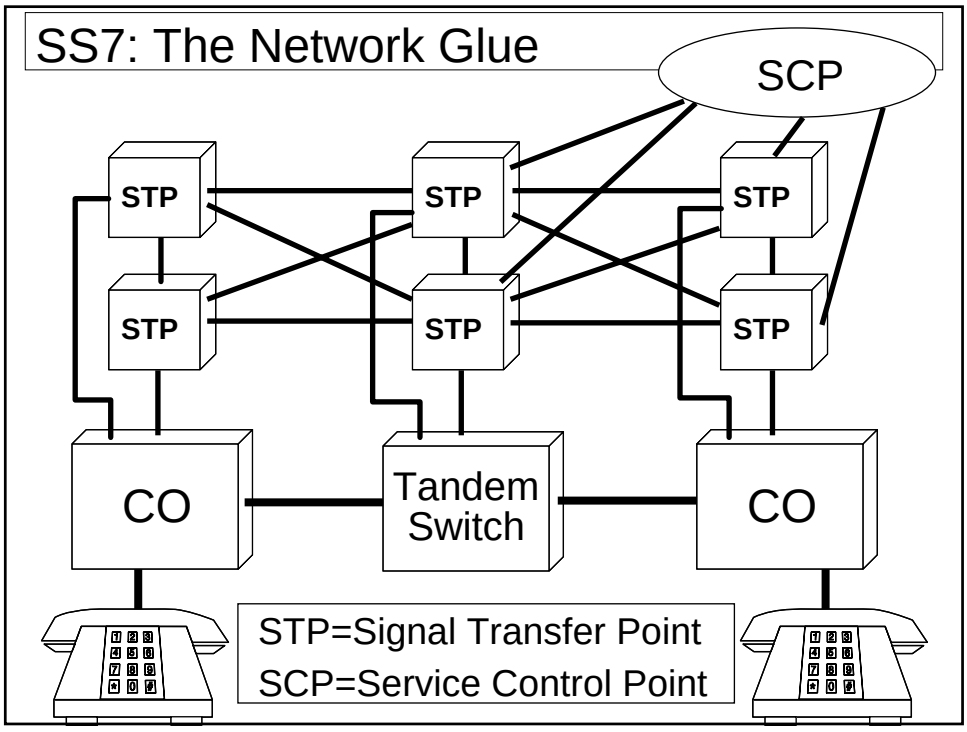
ISDN Primary Access

- Medium is one or more DS1s
- The medium could have a higher bit rate than DS1, but H_{12} is the fastest channel provided
- User must have at least one D channel. For primary access, D = 64 Kb/s
- Any B, H_0, H_{11} and H_{12} channels that will "fit" into the total bandwidth





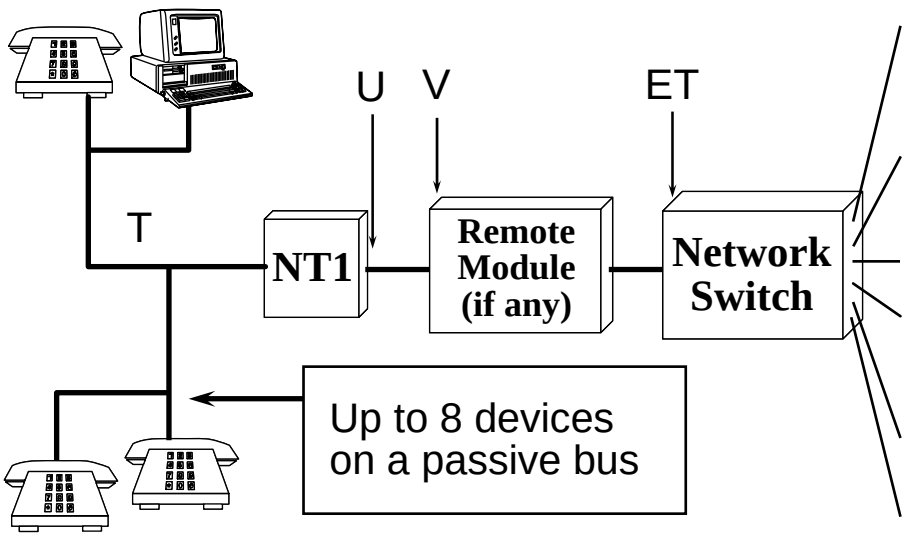




Definition: Passive Bus

- The physical layer of ISDN for the basic access structure provides for a "Passive Bus."
- It is O.K. to connect up to 8 TEs on a passive bus.
- Primary access structures cannot have a passive bus; i.e., they are only point-to-point.

ISDN System Reference Points



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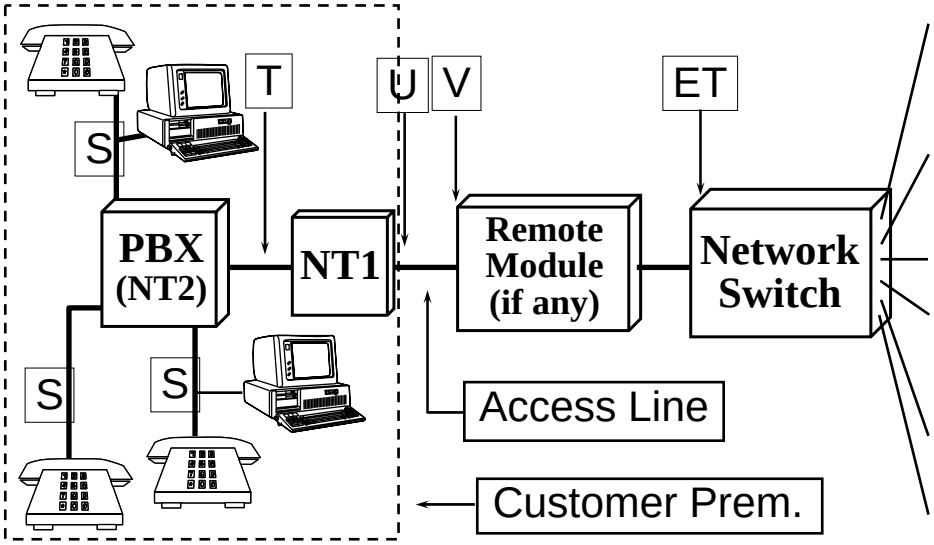
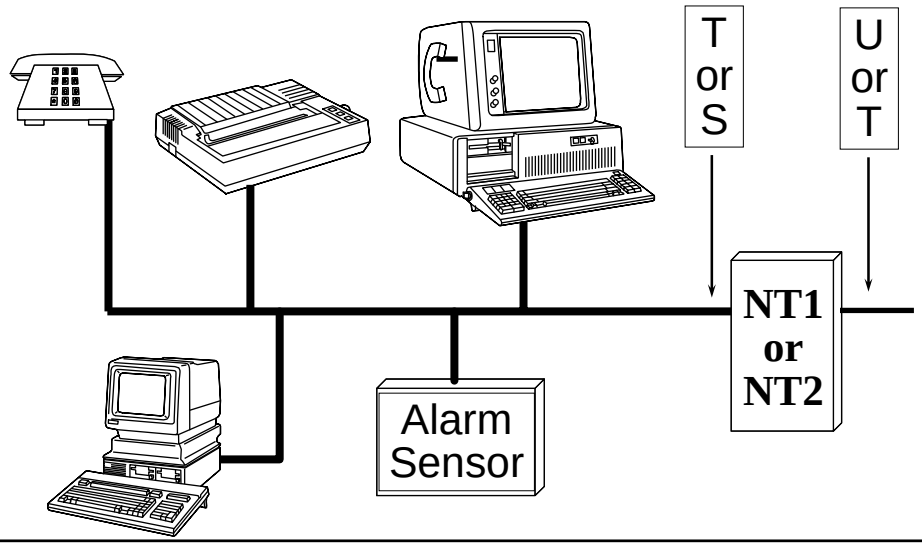


Please Note:

- Any S or T reference point can be either a basic access structure or a primary access structure.
- However, it is likely that the trunk between a PBX and a CO would not be basic.
- Any S or T reference point in the system can be a passive bus if it is a basic access structure.

A Possible Basic Access Configuration



Eye Patterns: Pulse Flow Across S or T for Basic Rate