

Network Technology B – Frame Relay

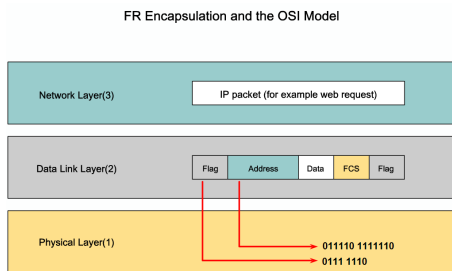
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- Packet-Switched connection-oriented or Virtual Circuit data link protocol.
- Invented by Stratacom 1986, that was later bought by Cisco in 1996.
- Meant to replace X.25 due to some drawbacks with this protocol.
 - ▶ Designed in the 1970s
 - ▶ Low data rate (64Kbps)
 - ▶ Extensive flow control due to error prone transmission media.
 - ▶ Operated in both Data Link and Network layer.
- Before Frame-Relay, only other option were dedicated lines.
 - ▶ Expensive, $n(n-1)/2$ *dedicated lines where needed*
 - ▶ Seldom the entire line was fully utilized.

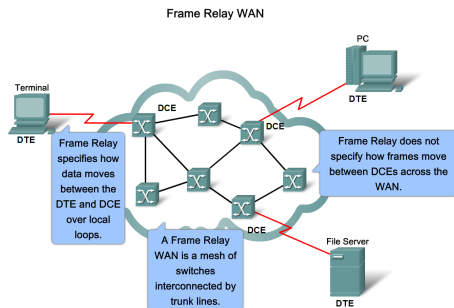
- Higher speed (up to 44 Mbps)
- Operates only in physical layer and data link layer (makes it compatible with IP).
- Less overhead, depends on upper layer protocols for flow and error control.



Figur: Frame Relay Encapsulation [2]

Frame Relay architecture

- Provides connectivity between two DTE-devices.
- Frame Relay network is accessed using either:
 - ▶ Frame Relay Access Device (FRAD)
 - ▶ Frame Relay compatible Router, Switch or Bridge.



Figur: Frame Relay Architecture [2]

- Frame Relay supports both SVC and PVC.
- A Switched Virtual Circuit consists of four operational states
 - ▶ Call Setup
 - ▶ Data Transfer
 - ▶ Idle
 - ▶ Call Termination
- A Permanent Virtual Circuit operates in Data Transfer or Idle only.

DLCI – Data Link Connection Identifier

- DLCI are used to identify a virtual circuit.
- DLCI are only locally significant.
- Multiple DLCI on the same interface.
- When used together with IP, a mapping must be done between DLCI and the destination IP address.
- Mapping can be done by static or dynamic mapping.

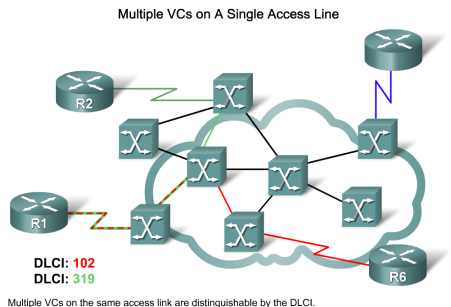
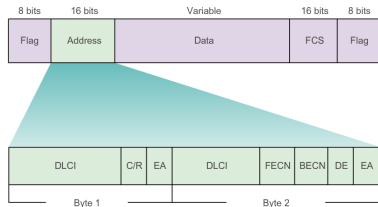


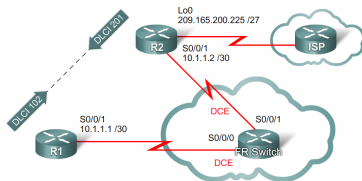
Figure: DLCIs to locally identify a virtual circuit [2]

- DLCI
- C/R – Undefined
- Extended Address
- Forward Explicit Congestion Notification
- Backward Explicit Congestion Notification
- Discard Eligible



Figur: Standard Frame Relay Frame[1]

Static DLCI mapping

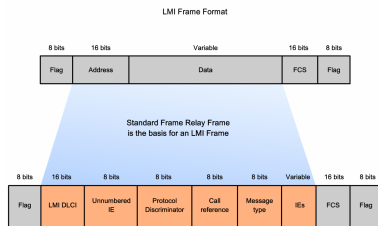


Figur: Frame Relay Topology [2]

Configure Frame-relay static mapping

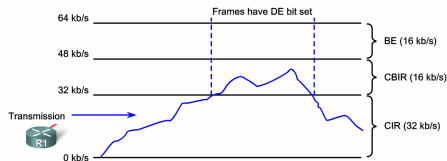
```
encapsulation frame-relay  
no frame-relay inverse-arp  
frame-relay map ip 10.1.1.2 102 broadcast
```


- Frame Relay was developed to be as simple as possible.
- Omitted everything that could in some way introduce extra delay.
- LMI was introduced to extend Frame Relays capabilities.
- LMI provides:
 - ▶ Connection status, to ensure the connection is still working.
 - ▶ Multicasting
 - ▶ Global addresses.
 - ▶ Flow Control.

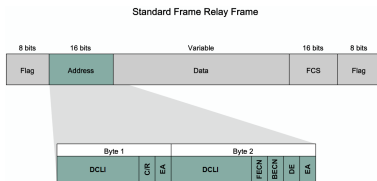


Figur: LMI Format [2]

- Committed Information Rate (CIR)
- Committed Burst Information Rate (CBIR)
- Excess Burst Size (BE)
- Data that exceeds CBIR will be marked as *Discard Eligible (DE)*



Figur: Traffic bursts



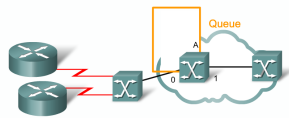
Figur: Standard Frame Relay frame [2]

FR Bandwidth Control: Queuing

While switch A is putting a large frame on interface 1, other frames for this interface are queued.

Downstream devices are warned of the queue by setting the FECN bit

Upstream devices are warned of the queue by setting the BECN bit- even though they may not have contributed to the congestion



While switch A is putting a large frame on interface 1, other frames for this interface are queued.

Figur: Explicit Congestion Notification [2]



Connecting networks : companion guide. Indianapolis, Indiana, 2014.



Bob Vachon och Rick Graziani. *Accessing the WAN : CCNA exploration companion guide.* Indianapolis, Ind.: Cisco Press, 2008.
ISBN: 978-1-58713-205-6 (hardcover w/cd).