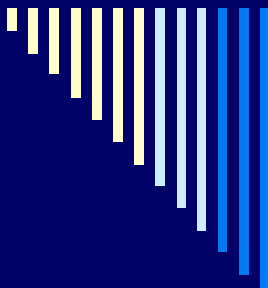


# Frame Relay

**Module 5, Review**

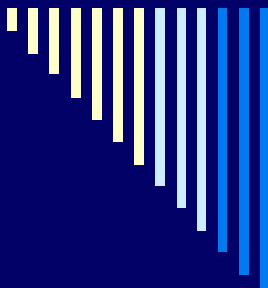
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## 5.1.1 Introducing Frame Relay

- Frame Relay uses a subset of the high-level data link control (HDLC) protocol called Link Access Procedure for Frame Relay (LAPF).
  - The various virtual circuits on a single access line can be distinguished because each VC has its own Data Link Channel Identifier (DLCI). The DLCI usually has only local significance and may be different at each end of a VC.
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## 5.1.1 Introducing Frame Relay

- Frame Relay is often used to interconnect LANs. When this is the case, a router on each LAN will be the DTE. A serial connection, such as a T1/E1 leased line, will connect the router to a Frame Relay switch of the carrier at the nearest point-of-presence for the carrier. The Frame Relay switch is a DCE device. Frames from one DTE will be moved across the network and delivered to other DTEs by way of DCEs.
- Computing equipment that is not on a LAN may also send data across a Frame Relay network. The computing equipment will use a Frame Relay access device (FRAD) as the DTE

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## 5.1.2 Frame Relay terminology

- The connection through the Frame Relay network between two DTEs is called a virtual circuit (VC).
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## 5.1.2 Frame Relay terminology

- ❑ The FRAD or router connected to the Frame Relay network may have multiple virtual circuits connecting it to various end points.
  - ❑ This makes it a very cost-effective replacement for a mesh of access lines. With this configuration, each end point needs only a single access line and interface.
  - ❑ More savings arise as the capacity of the access line is based on the average bandwidth requirement of the virtual circuits, rather than on the maximum bandwidth requirement.
  - ❑ Minimizes equipment expenditure
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## 5.1.3 Frame Relay stack layered support

- If the Frame CheckSum (FCS) does not match the address and data fields at the receiving end, the frame is discarded without notification
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## 5.1.4 Frame Relay bandwidth and flow control

- To avoid delays, frame relay switches incorporate a policy of dropping frames from a queue to keep the queues short.
    - Frames with their DE bit set will be dropped first.
  - When a switch sees its queue increasing, it tries to reduce the flow of frames to it.
    - It does this by notifying DTEs of the problem by setting the Explicit Congestion Notification (ECN) bits in the frame address field.
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## 5.1.5 Frame Relay address mapping and topology

- For large networks, full mesh topology is seldom affordable. This is because the number of links required for a full mesh topology grows at almost the square of the number of sites.
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## 5.1.6 Frame Relay LMI

- The LMI extensions include the following:
    - The heartbeat mechanism, which verifies that a VC is operational
    - The multicast mechanism
    - The flow control
    - The ability to give DLCIs global significance
    - The VC status mechanism
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## 5.1.6 Frame Relay LMI

- The 10-bit DLCI field allows VC identifiers 0 through 1023. The LMI extensions reserve some of these identifiers.

**Non-data DLCIs**

FIGURES

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0	LMI (ANSI, ITU)
1..15	Reserved for future use
992..1007	CLLM
1008..1022	Reserved for future use (ANSI, ITU)
1019..1022	Multicasting (Cisco)
1023	LMI (Cisco)

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## 5.1.7 Stages of Inverse ARP and LMI operation

- LMI status messages combined with Inverse ARP messages allow a router to associate network layer and data link layer addresses.
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## 5.2.2 Configuring a static Frame Relay map

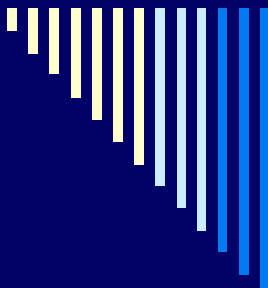
- Use the `frame-relay map protocol protocol-address dlci [broadcast]` command to statically map the remote network layer address to the local DLCI.
  - To change the encapsulation to Frame Relay use the `encapsulation frame-relay [cisco | ietf]` command.
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## 5.2.3 Reachability issues with routing updates in NBMA

- One way to solve the split-horizon problem is to use a fully meshed topology. However, this will increase the cost because more PVCs are required. **The preferred solution is to use subinterfaces.**
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## 5.2.4 Frame Relay subinterfaces

### □ Multipoint –

- A single multipoint subinterface is used to establish multiple PVC connections to multiple physical interfaces or subinterfaces on remote routers.
  - All the participating interfaces would be in the same subnet.
  - The subinterface acts like an NBMA Frame Relay interface so routing update traffic is subject to the split-horizon rule.
  - The physical interface does not have an IP address
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## 5.2.6 Verifying the Frame Relay configuration

- The following information interprets the **show frame-relay map** output that appears in Figure :
  - 100 is the decimal value of the local DLCI number
  - 0x64 is the hex conversion of the DLCI number,  $0x64 = 100$  decimal
  - 0x1840 is the value as it would appear on the wire because of the way the DLCI bits are spread out in the address field of the Frame Relay frame
  - 10.140.1.1 is the IP address of the remote router, dynamically learned via the Inverse ARP process
  - Broadcast/multicast is enabled on the PVC
  - PVC status is active

Verifying Frame Relay Operation

FIGURES

```
1
2
3
4
5
Router#show frame-relay map
Serial0/0 (up) : ip 10.140.1.1 dlci 100 (0x64,0x1840),
                dynamic, broadcast, status defined, active
```



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## 5.2.7 Troubleshooting the Frame Relay configuration

- The **debug frame-relay lmi** command gives the “dlci 100, status 0x2” means that the status of DLCI 100 is active. The possible values of the status field are as follows:
    - **0x0** – Added/inactive means that the switch has this DLCI programmed but for some reason it is not usable. The reason could possibly be the other end of the PVC is down.
    - **0x2** – Added/active means the Frame Relay switch has the DLCI and everything is operational.
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