Accessing the WAN

Chapter 3 – Frame Relay

Study Guide / Key concepts

*Frame Relay is a high-performance WAN protocol that operates at the **physical** and **Data-Link** layers of the OSI reference model. It has become one of the most extensively used WAN protocols, primarily because it is **inexpensive** compared to dedicated lines. Instead of paying for an end-to-end, dedicated connection, customers only pay for the **local loop** (last mile) and the **bandwidth** they purchase from the provider.*

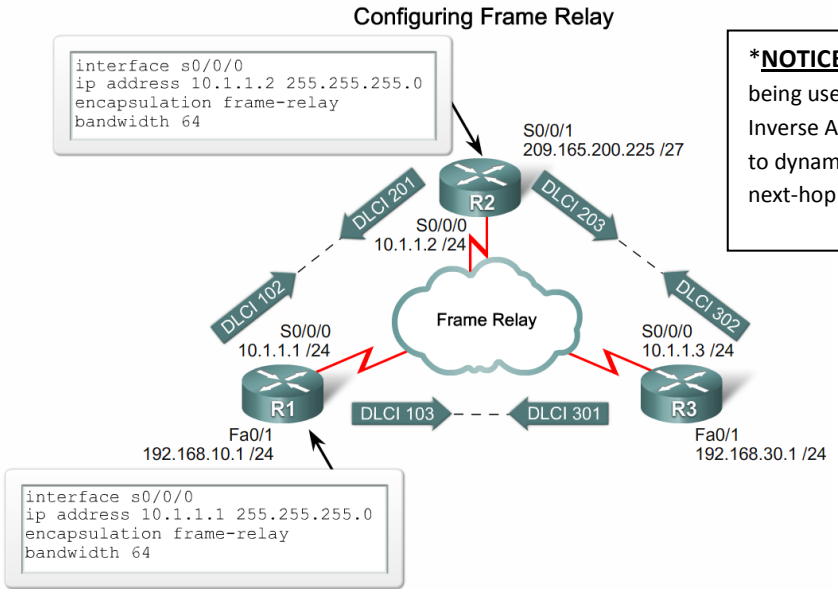
Virtual Circuits (VCs) provide a bidirectional communication path from one device to another. VCs are identified by **DLCI**s (Data-Link Control Identifiers). DLCI values typically are assigned by the Frame Relay service provider (for example, the telephone company). Frame Relay DLCIs have *local significance*, which means that the values themselves are not unique in the Frame Relay WAN. A DLCI identifies a VC to the equipment at an endpoint. *A DLCI has no significance beyond the single link*.

Mapping Functions:

Inverse ARP - The *Inverse Address Resolution Protocol* **dynamically** obtains Layer 3 addresses of other stations from Layer 2 addresses, such as the **DLCI** in Frame Relay networks.

LMI - Basically, the Local *Management Interface* is a "keepalive" mechanism that provides status information about Frame Relay connections between the router (DTE) and the Frame Relay switch (DCE). Three types of LMIs are supported by Cisco devices: Cisco (default), ANSI, and q933a.

Basic Frame Relay configuration:



*__NOTICE__: Static maps are *NOT* being used in this example. Instead, Inverse ARP (default) is being used to dynamically map DLCIs to the next-hop addresses.

Sometimes it is advantagous to use **static maps** when configuring Frame Relay. Once such example is when using routing prorocols such as RIP, EIGRP, and OSPF.

Setting a static map:

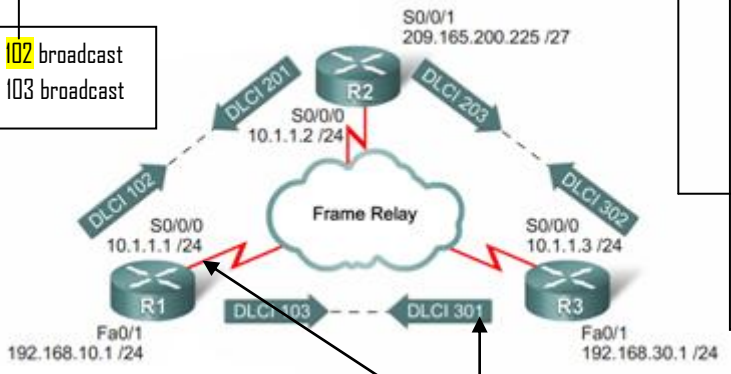
#frame-relay map protocol protocol-address dlci [broadcast]

(This is in addition to the commands issued in the example above)

Next-hop / destination

Frame Relay, ATM, and X.25 are *nonbroadcast multiaccess* (NBMA) networks. NBMA networks allow only data transfer from one computer to another over a VC or across a switching device. NBMA networks do not support multicast or broadcast traffic, so a single packet cannot reach all destinations. This requires you to broadcast to replicate the packets manually to all destinations.

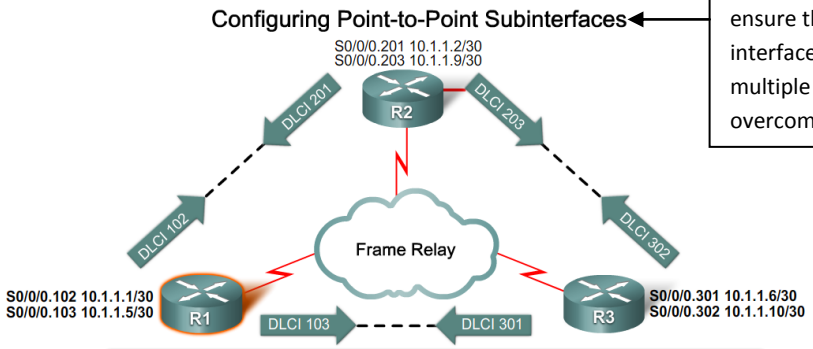
R1(config-if)#frame-relay map ip 10.1.1.2 102 broadcast
R1(config-if)#frame-relay map ip 10.1.1.3 103 broadcast



R3(config-if)#frame-relay map ip 10.1.1.1 301 broadcast
R3(config-if)#frame-relay map ip 10.1.1.2 302 broadcast

Setting up Frame Relay with **subinterfaces**:

Frame Relay **subinterfaces** ensure that a single physical interface is treated as multiple virtual interfaces to overcome *split horizon* rules.



Frame relay *encapsulation* is set on the physical interface. The only other command issued on the physical interface is the "no shut" command.

```
interface s0/0/0
 no ip address
 encapsulation frame-relay
 no shut
exit

interface s0/0/0.102 point-to-point
 ip address 10.1.1.1 255.255.255.252
 bandwidth 64
 frame-relay interface-dlci 102
exit

interface s0/0/0.103 point-to-point
 ip address 10.1.1.5 255.255.255.252
```

Serial subinterfaces allow a virtual circuit (VC) to behave as a point-to-point WAN connection.

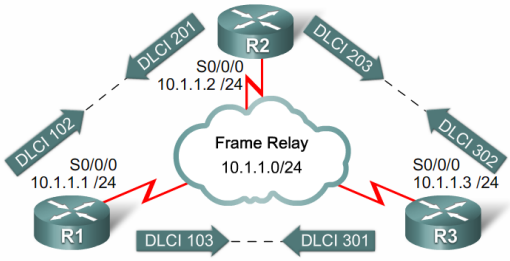
Each pair of point-to-point routers share a subnet, usually with a "/30" CIDR.

As mentioned previously, in addition to paying for the connection to the CO (local loop), a frame relay customer pays for ***bandwidth***. This includes terms such as Access Rate, Committed Information Rate (CIR), Excess Burst (BE), Committed Burst Information Rate (CBIR), and Discard Eligible (DE).

Paying for Frame Relay

Term	Access
Access Rate or Port Speed	The capacity of the local loop
Committed Information Rate (CIR)	The capacity through the local loop guaranteed by the provider

Frame Relay Bursting



PVC DCLI	CIR (Normal)	CBIR (example)	BE
DCLI 102	32 kb/s	48 kb/s	16 kb/s
DCLI 103	16 kb/s	0 kb/s	48 kb/s
	All frames are forwarded	Frames are forwarded but marked DE	Frames will most likely will be dropped

Frame Relay relies on *upper protocols* to handle error correction; receiving devices **drop** any frames that contain errors <u>without notifying the sender</u>.

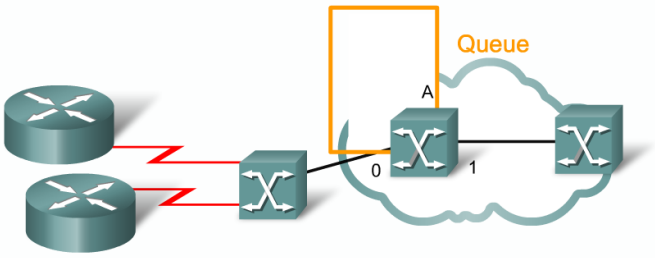
Frame Relay **DOES**, however, utilize tools for *flow control*.

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



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