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CCIE LAB

DEMO Version

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Good studying!

Technical and Support Team
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Section A - Older labs

Section B - Newer labs

Note 1: There are two sections, Section A and Section B. There is some overlap between the Sections.

Note 2: Section A contains 9 labs. Section B contains 8 Labs. Total number of labs is 17.

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Lab Preparation Scenario: Frame Relay

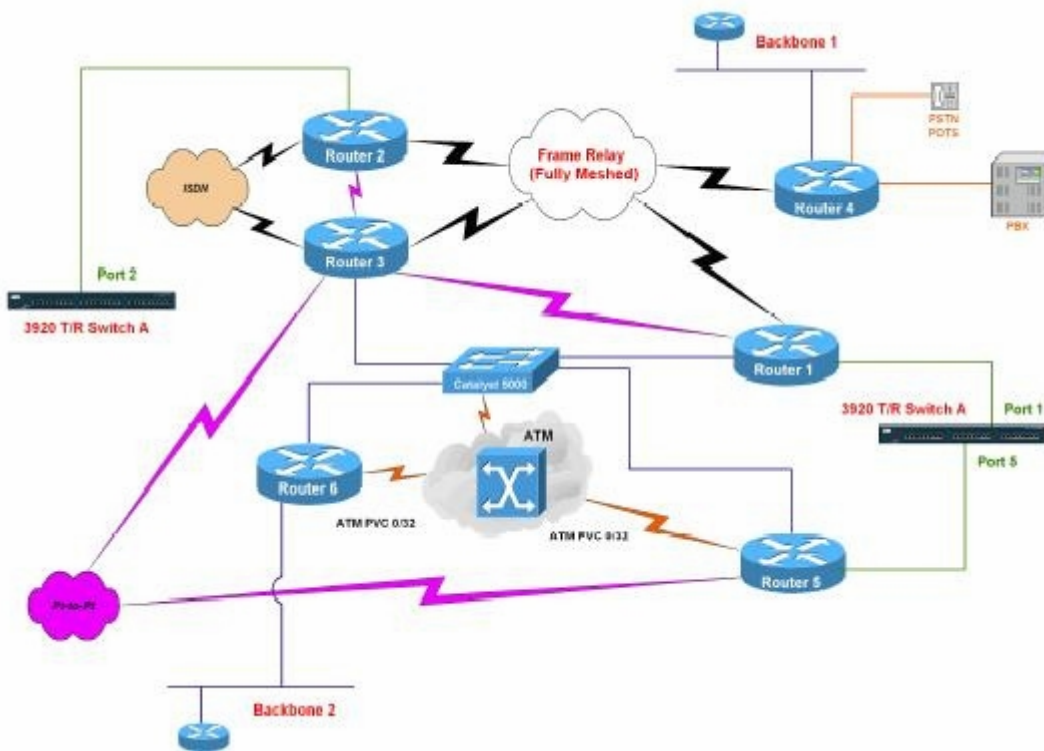
Topic Covered

- Encapsulation
- LMI
- Point-to-Point
- Multipoint
- Frame-Relay Switch
- Split-Horizon
- EIGRP

Difficulty Level: CCIE TM

Average Completion Time: 1 Hour

Standard Topology



Standard TCP/IP Addressing and SPID Information

R1 (3629)

Loop0 192.168.1.1 /24 Loopback

E0/0 172.16.136.1 /26 Ethernet Segment to Catalyst 3/1

T0/0 172.16.15.1 /28 Token Ring Segment to 2920

S1/1 172.16.31.1 /30 Serial to R3
S1/0 unassigned Frame-relay

R2 (3620)

Loop0 192.168.2.2 /24 Loopback
TO/0 172.16.2.2 /24 Token Ring Segment to 3920
BRI0/0 172.16.230.2 /24 BRI to R3
S1/1 172.16.32.2/24 Serial to R3
S1/0 unassigned Frame-relay

R3 (2610)

Loop0 192.168.3.3 /24 Loopback
E0/0 172.16.136.3 /26 Ethernet Segment to Catalyst 3/3
BRI0/0 172.16.230.3 /24 ISDN to R2
S1/3 172.16.35.1 /30 Serial to R5
S1/2 172.16.32.3/24 Serial to R2
S1/0 unassigned Frame-relay

R4 (2610)

Loop0 192.168.4.4 /24 Loopback
E0/0 10.1.4.4 /22 Ethernet Segment to BB1
S0(0) unassigned Frame-relay

R5 /3620)

Loop0 192.168.5.5 /24 Loopback
E0/0 172.16.136.5 /26 Ethernet Segment to Catalyst 3/5
T0/0 172.16.15.5 /28 Token Ring Segment to 3920
S0/0 172.16.35.2 /30 Serial link to R3
A1/0 172.16.56.5 /30 ATM-R6

R6 (3640)

Loop0 192.168.6.6 /24 Loopback
FA0/0 172.16.136.6 /26 Ethernet segment -R2
E2/0 10.2.6.6 /23 Ethernet segment -BB2
A1/0 172.16.56.6 /30 ATM-R5

ISDN Information

Switch Type

Basis NI1

R2

SPID1: 42255501210101
SPID2: 42255501220101

R3

SPID1: 42255501310101
SPID2: 42255501320101

Technical Tasks

- A. Shutdown all LAN, ISDN, and ATM Interfaces. The frame-relay cloud should be configured with R2 as the hub with R1, R3, and R4 as spokes. Make use of no other DLCI's than those necessary to accomplish this. Configure the routers with addressing from the 172.16.234.0/24 subnet. Ensure that R2 will not broadcast at a rate faster than 5120 bits per second.
- B. Back-back frame-relay. You must use the same DLCI on both ends. One side needs to assume the frame relay DCE function. Whichever router will be the DCE must first enable frame-relay switching globally. This does not have to be the same end that provides clock.
- C. There are two types of frame-relay encapsulation, Cisco and IETF.
- D. There are three types of LMI. ANSI uses DLCI 0.
- E. You may want to disable auto-summary under EIGRP. If you have problems getting routes to R4, check split-horizon.

Technical Verification

Technical Verification For Task A

r1#sh fram map

```
Serial1/0 (up):ip 172.16.234.2 dlci 122(0x7A,0x1CA0), static,
    broadcast,
    CISCO, status defined, active
Serial1/0 (up):ip 172.16.234.3 dlci 122(0x7A,0x1CA0), static,
    broadcast,
    CISCO, status defined, active
Serial1/0 (up):ip 172.16.234.4 clci 122(0x7A,0x1CA0), static,
    broadcast,
    CISCO, status defined, active
```

r2#sh fram map

```
Serial1/0 (up):ip 172.16.234.1 dlci 221(0xDD,0x34D0), static.
    broadcast,
    CISCO, status defined, active
Serial1/0 (up):ip 172.16.234.3 dlci 223(0xDF,0x34F0), static,
    broadcast,
    CISCO, status defined, active
```

```
Serial1/0 (up):ip 172.16.234.4 dlci 224(0xE0,0x3800), static,  
broadcast,  
CISCO, status defined, active
```

r3#sh fram map

```
Serial1/0 (up):ip 172.16.234.1 dlci 322(0x142,0x5020), static,  
broadcast,  
CISCO, status defined, active  
Serial1/0 (up):ip 172.16.234.2 dlci 322(0x142,0x5020), static,  
broadcast,  
CISCO, status defined, active  
Serial1/0 (up):ip 172.16.234.4 dlci 322(0x142,0x5020), static,  
broadcast,  
CISCO, status defined, active
```

r2#sh int s1/0

```
Serial 1/0 is up, line protocol is up
```

Hardware is DSCC4 Serial

```
Internet address is 172.16.234.2/24  
MTU 1500 bytes, BW 2048 Kbit, DLY 20000 usec,  
reliability 255/255m, txload 1/255, rxload 1/255
```

Encapsulation FRAME-RELAY, loopback not set

```
Keepalive set (10 sec)  
LMU enq sent 224, LMI stat recvd 255, LMI upd recvd 0, DTE LMI ip  
LMI enq recvd 0, LMI stat sent 0, LMI upd sent 0  
LMI DLCI 0 LMI type is ANSI Annex D frame relay DTE  
FR SVC disabled, LAPF satte down  
Broadcast queue 0/100, broadcast sent/dropped 582/0, interface broadcast 19
```

The output does not show the byte size but it does show the packet size has changed from the default value of 64.

Technical Verification For Task B**r3#sh fram map | begin Serial1/1**

```
Serial1/1 (up):ip 172.16.31.1 dlci 31(0x1F,0x4F0), dynamic.  
broadcast,, status defined, active  
Serial1/1 (up):ip 172.16.32.2 dlci 32(0x20,0x800), dynamic,  
broadcast,, status defined, active
```

Technical Verification For Task C

```
r3#sh fram map | begin Serial1/3
```

Serial1/3 (up):ip 172.16.35.2 dlci 35(0x23,0x830), dynamic,
broadcast,
IETF, status defined, active

Technical Verification For Task D

r3#sh int s1/3

Serial 1/3 is up, line protocol is up
Hardware is CD2430 in sync mode
Internet address is 172.16.35.1/30
MTU 1500 bytes, BW 128 Kbit, DLY 20000 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation FRAME-RELAY IETF, loopback not set
Keepalive set (10 sec)
LMI enq sent 0, LMI stat recvd 0, LMI upd recvd 0
LMI eng recvd 127, LMI stat sent 127, LMI upd sent 0, DCE LMI up
LMI CLCI 0 LMI type is ANSI Annex D frame relay DCE

Technical Verification For Task E

The routing tables of all routers are included here. The legend normally provided in router output has been deleted.

Router 1

r2#sh ip ro

172.16.0.0/16 is variably subnetted, 4 subnets, 2 masks
C 172.16.234.0/24 is directly connected, Serial1/0
C 172.16.32.0/24 is directly connected, Serial1/1
D 172.16.35.0/30 [90/21024000] via 172.16.32.3, 00:13:15, Serial 1/1
[90/21024000] via 172.16.234.3, 00:13:15, Serial1/0
D 172.16.31.0/30 [90/2273792] via 172.16.234.1, 00:13:15, Serial1/0
D 192.168.4.0/24 [90/1889792] via 172.16.234.4, 00:12:42, Serial1/1
D 192.168.5.0/24 [90/21152000] via 172.16.32.3, 00:13:16, Serial1/1
[90/21152000] via 172.16.234.3, 00:13:16, Serial1/0
D 192.168.1.0/24 [90/1889792] via 172.16.234.1, 00:13:16, Serial1/0
C 192.168.2.0/24 is directly connected, Loopback0
D 192.168.3.0/24 [90/1889792] via 172.16.32.3, 00:13:16, Serial1/1
[90/1889792] via 172.16.234.3, 00:13:16, Serial1/0

Router 3

r3#sh ip ro

- 172.16.0.0/16 is variably subnetted, 4 subnets, 2 masks
- C 172.16.234.0/24 is directly connected, Serial1/0
- C 172.16.32.0/24 is directly connected, Serial1/2
- C 172.16.35.0/30 is directly connected, Serial1/3
- C 172.16.31.0/30 is directly connected, Serial1/1
- D 192.168.4.0/24 [90/21152000] via 172.16.32.2, 00:12:50, Serial1/2**
 - [90/21152000] via 172.16.234.2, 00:12:50, Serial1/0
- D 192.168.5.0/24 [90/20640000] via 172.16.36.2, 00:13:20, Serial1/3
- D 192.168.1.0/24 [90/20640000] via 172.16.31.1, 00:13:21, Serial1/1
- D 192.168.2.0/24 [90/20640000] via 172.16.32.2, 00:12:21, Serial1/2
 - [90/20640000] via 172.16.234.2, 00:13:21, Serial1/0
- C 192.168.3.0/24 is directly connected, Loopback0

A. Router 4

R4#sh ip ro

- 172.16.0.0/16 is variably subnetted, 4 subnets, 2 masks
- C 172.16.234.0/24 is directly connected, Serial0/0
- D 172.16.32.0/24 [90/2681856] via 172.16.234.2, 00:12:56, Serial0/0
- D 172.16.35.0/30 [90/21536000] via 172.16.234.2, 00:12:56, Serial0/0
- D 172.16.31.0/30 [90/3193856] via 172.16.234.2, 00:12:56, Serial0/0
- C 192.168.4.0/24 is directly connected, Loopback0
- D 192.168.5.0/24 [90/21664000] via 172.16.234.2, 00:12:56, Serial0/0
- D 192.168.1.0/24 [90/2809856] via 172.16.234.2, 00:12:58, Serial0/0
- D 192.168.2.0/24 [90/2297856] via 172.16.234.2, 00:12:58, Serial0/0
- D 192.168.3.0/24 [90/2809856] via 172.16.234.2, 00:12:48, Serial0/0

B. Router 5

R5#sh ip ro

- 192.16.0.0/16 is variably subnetted, 4 subnets, 2 masks
- D 172.16.234.0/24 [90/21024000] via 172.16.35.1, 00:21:07, Serial0/0**
- D 172.16.32.0/24 [90/21024000] via 172.16.35.1, 00:21:07, Serial0/0
- C 172.16.35.0/30 is directly connected, Serial0/0
- D 172.16.31.0/30 [90/21024000] via 172.16.35.1, 00:21:07, Serial 0/0
- D 192.168.4.0/24 [90/21664000] via 172.16.35.1, 00:13:07, Serial0/0
- C 192.168.5.0/24 is directly connected, Loopback0
- D 192.168.1.0/24 [90/21152000] via 172.16.35.1, 00:20:14, Serial0/0
- D 192.168.2.0/24 [90/21152000] via 172.16.35.1, 00:20:13, Serial0/0
- D 192.168.3.0/24 [90/1889792] via 172.16.35.1, 00:21:09, Serial0/0

C. Router 1

r1#sh run

```
interface Loopback0
  ip address 192.168.1.1 255.255.255.0
!
interface Ethernet0/0
  no ip address
  shutdown
  half-duplex
!
interface TokenRing0/0
  no ip address
  shutdown
  ring-speed 16
!
interface Serial1/0
  ip address 172.16.234.1 255.255.255.0
  encapsulation frame-relay
  frame-relay map ip 172.16.234.2 122 broadcast
  frame-relay map ip 172.16.234.3 122 broadcast
  frame-relay map ip 172.16.234.4 122 broadcast
  no frame-relay inverse-arp
!
interface Serial1/1
  ip address 172.16.31.1 255.255.255.252
  encapsulation frame-relay
  frame-relay interface-dlci 31
!
router eigrp 1
  network 172.16.0.0
  network 192.168.1.0
  no auto-summary
  no eigrp log-neighbor-changes
```

Router 2

```
r2#sh run
interface Loopback0
  ip address 192.168.2.2 255.255.255.0
!
interface BRIO/0
  no ip address
  shutdown
!
interface Ethernet0/0
  no ip address
  shutdown
```

```
!
    half-duplex
!
interface TokenRing0/0
  no ip address
  shutdown
  ring-speed 16
!
interface Serial1/0
  ip address 172.16.234.2 255.255.255.0
  encapsulation frame-relay
  no ip split-horizon eigrp 1
  frame-relay map ip 172.16.234.1 221 broadcast
  frame-relay map ip 172.16.234.3 223 broadcast
  frame-relay map ip 172.16.234.4 224 broadcast
  no frame-relay inverse-arp
  frame-relay broadcast-queue 100 5120 100
!
interface Serial1/1
  ip address 172.16.32.2 255.255.255.0
  encapsulation frame-relay
  frame-relay interface-dlci 32
!
```

Router 3

```
r3#sh run
frame-relay switching
!
interface Loopback0
  ip address 192.168.3.3 255.255.255.0
!
interface Ethernet0/0
  no ip address
  shutdown
  half-duplex
!
interface BRI0/0
  no ip address
  shutdown
!
interface Serial1/0
  ip address 172.16.234.3 255.255.255.0
  encapsulation frame-relay
  frame-relay map ip 172.16.234.1 322 broadcast
  frame-relay map ip 172.16.234.2 322 broadcast
```

```
frame-relay map ip 172.16.234.4 322 broadcast
no frame-relay inverse-arp
!
interface Serial1/1
ip address 172.16.31.2 255.255.255.252
encapsulation frame-relay
clockrate 64000
frame-relay interface-dlci 31
frame-relay intf-type dce
!
interface Serial1/2
ip address 172.16.32.3 255.255.255.0
encapsulation frame-relay
clockrate 64000
frame-relay interface-dlci 32
frame-relay intf-type dce
!
interface Serial1/3
ip address 172.16.35.1 255.255.255.252
encapsulation frame-relay IETF
clockrate 64000
frame-relay interface-dlci 35
frame-relay lmi-type ansi
frame-relay intf-type dce
!
router eigrp 1
network 172.16.0.0
network 192.168.3.0
no auto-summary
no eigrp log-neighbor-changes
```

Router 4

```
r4#sh run
interface Loopback0
ip address 192.168.4.4 255.255.255.0
!
interface Ethernet0/0
no ip address
shutdown
half-duplex
!
interface Serial0/0
ip address 172.16.234.4 255.255.255.0
```

```
encapsulation frame-relay
frame-relay map ip 172.16.234.1 422 broadcast
frame-relay map ip 172.16.234.2 422 broadcast
frame-relay map ip 172.16.234.3 422 broadcast
no frame-relay inverse-arp
!
interface Serial0/1
  no ip address
  shutdown
!
router eigrp 1
  network 172.16.0.0
  network 192.168.4.0
  no auto-summary
  no eigrp log-neighbor-changes
```

Router 5

```
r4#sh run
interface Loopback0
  ip address 192.168.5.5 255.255.255.0
!
interface Ethernet0/0
  no ip address
  shutdown
  half-duplex
!
interface Serial0/0
  ip address 172.16.35.2 255.255.255.252
  encapsulation frame-relay IETF
  frame-relay interface-dlci 35
  frame-relay lmi-type ansi
!
interface TokenRing0/0
  no ip address
  shutdown
  ring-speed 16
!
interface Serial0/1
  no ip address
  shutdown
!
interface ATM1/0
  no ip address
  shutdown
```

```
no atm ilmi-keepalive  
!  
router eigrp 1  
network 172.16.0.0  
network 192.168.5.0  
no auto-summary  
no eigrp log-neighbor-changes
```

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