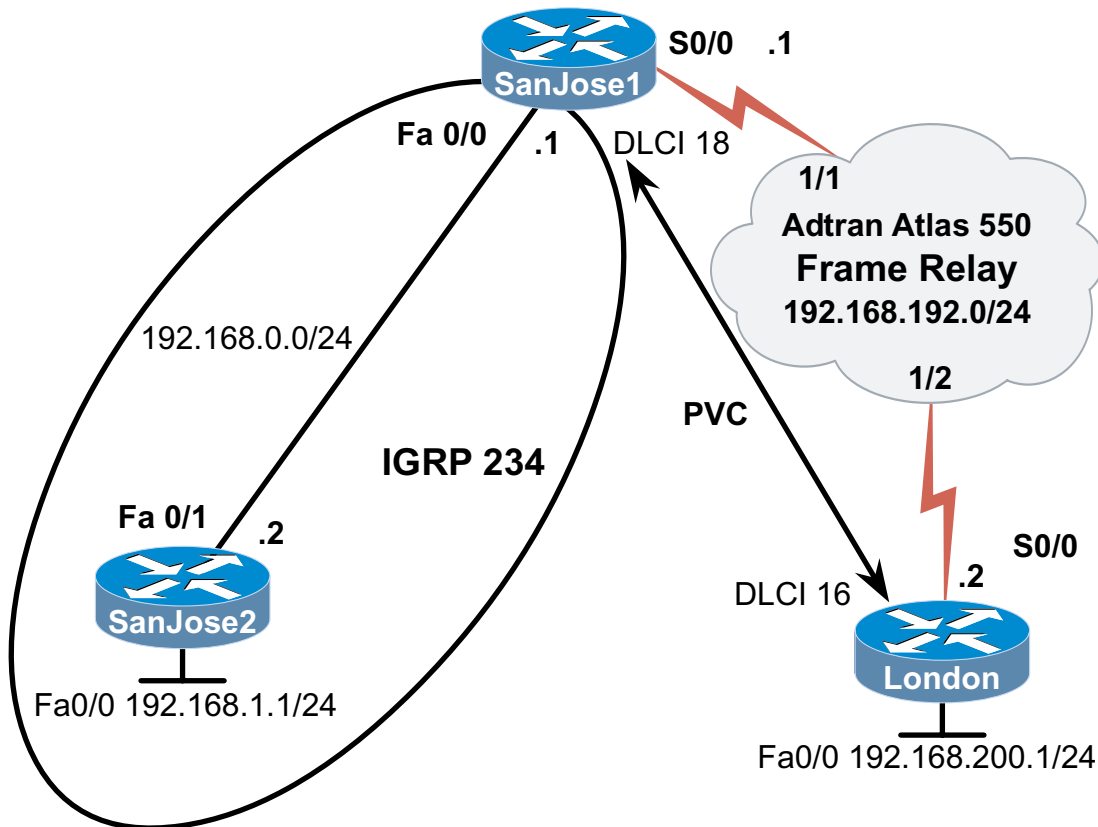


### 8.3.2: On-Demand Routing



#### Objective

Configure and redistribute On-Demand Routing (ODR) over Frame Relay.

#### Scenario

As the network administrator for the International Travel Agency (ITA), you are responsible for establishing connectivity between company headquarters (San Jose) and European regional headquarters (London). Eleven LANs are directly connected to a single router in London with one Frame Relay WAN link. Since the London router is part of a stub network, it only needs a default route toward San Jose1. Not using a routing protocol over the slow WAN link will save bandwidth. In order to send data back to London, a static route could be placed on SanJose1 and redistributed, but you know that the local administrators in London will be adding LANs in the coming weeks. Also, there are other regional sites adding LANs. To reduce the burden on you and your staff, you decide to implement ODR as a way to dynamically add routes to the network without the overhead of routing protocols.

#### Step 1

Physically build the network as shown in the diagram. If you are using an Adtran Atlas 550 WAN emulator, ensure that the cables are connected to the correct ports.

#### Step 2

Configure IGRP on only the two San Jose routers. Also, use explicit commands to configure Frame Relay between SanJose1 and London, as shown here:

```

SanJose1(config)#interface fastethernet 0/0
SanJose1(config-if)#ip address 192.168.0.1 255.255.255.0

SanJose1(config-if)#interface serial 0/0
SanJose1(config-if)#ip address 192.168.192.1 255.255.255.0
SanJose1(config-if)#encapsulation frame-relay
SanJose1(config-if)#frame-relay map ip 192.168.192.2 18 broadcast
SanJose1(config-if)#frame-relay lmi-type ansi
SanJose1(config-if)#exit
SanJose1(config)#router igrp 234
SanJose1(config-router)#network 192.168.192.0
SanJose1(config-router)#network 192.168.0.0

```

### Step 3

Verify Frame Relay is working by pinging from SanJose1 to London (192.168.192.2). The pings should be successful; troubleshoot as necessary.

View the routing table on SanJose2:

```

SanJose2#show ip route
<output omitted>

Gateway of last resort is not set

I    192.168.192.0/24 [100/80135] via 192.168.0.1, FastEthernet0/1
C    192.168.0.0/24 is directly connected, FastEthernet0/1
C    192.168.1.0/24 is directly connected, FastEthernet0/0

```

1. Does SanJose2's routing table include an entry for all networks in the diagram?

---

SanJose2 has routes to all networks except the London LAN. Try pinging London's WAN interface (192.168.192.2) from SanJose2 this time.

2. Since SanJose2 has a route to the Frame Relay link, why are the pings failing?

---

Verify that London has a route back to SanJose2, using the **show ip route** command:

```

London#show ip route
<output omitted>

Gateway of last resort is not set

C    192.168.192.0/24 is directly connected, Serial0/0
C    192.168.200.0/24 is directly connected, FastEthernet0/0

```

London has not learned any routes since it is not configured with a routing protocol. It doesn't make sense to run a dynamic routing protocol on a stub router, such as London. Simply configure a default route toward SanJose1.

```

London(config)#ip route 0.0.0.0 0.0.0.0 192.168.192.1

```

After you configure the default route, try to ping SanJose2's Fast Ethernet interface (192.168.1.1). This ping should now be successful; troubleshoot as necessary.

Now that London has all routing information needed to reach any network, check to see if SanJose1 has a complete routing table, as shown here:

```
SanJose1#show ip route
<output omitted>
```

Gateway of last resort is not set

```
C    192.168.192.0/24 is directly connected, Serial0/0
C    192.168.0.0/24 is directly connected, FastEthernet0/0
I    192.168.1.0/24 [100/120] via 192.168.0.2, 00:00:54,
    FastEthernet0/0
```

Note that SanJose1 does not have a route to 192.168.200.0 (London's LAN).

#### Step 4

Users in London will never receive data until SanJose1 learns a route to their LAN and distributes that route to SanJose2. A static route to 192.168.200.0/24 could be entered in SanJose1. As more LANs are implemented in London or any other remote stub network, you need to add more static routes. To avoid this hassle, you can implement On-Demand Routing (ODR).

Cisco routers send network IDs and subnet masks for adjacent networks in Cisco Discovery Protocol (CDP) frames. ODR tells the receiving router to build routes with the information. To configure ODR, simply enable it on the hub (receiving) router.

```
SanJose1(config)#router odr
```

After enabling ODR, check SanJose1's routing table again, as shown:

```
SanJose1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile,
       B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF
       inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external
       type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2,
       E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia -
       IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route
```

Gateway of last resort is not set

```
C    192.168.192.0/24 is directly connected, Serial0/0
C    192.168.0.0/24 is directly connected, FastEthernet0/0
I    192.168.1.0/24 [100/120] via 192.168.0.2, 00:00:34,
    FastEthernet0/0
O    192.168.200.0/24 [160/1] via 192.168.0.2
```

1. What could be the problem if you have enabled ODR but there is still no route to the London LAN?

---

Since ODR depends on CDP, verify that CDP is enabled. Issue the **show cdp** command on SanJose1.

```
SanJose1#show cdp
Global CDP information:
```

```
Sending CDP packets every 60 seconds
Sending a holdtime value of 180 seconds
Sending CDPv2 advertisements is enabled
```

CDP is enabled globally by default, with frames exchanged every 60 seconds. On SanJose1, view adjacent Cisco devices learned through CDP:

```
SanJose1#show cdp neighbors
Capability Codes: R - Router, T - Trans Bridge, B - Source Route
                  Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater

Device ID         Local Intrfce   Holdtme    Capability Platform
Port ID
SanJose2          Fas 0/0         149        R           2621
Fas 0/1
```

If, CDP does not appear to be running over the Frame Relay cloud between SanJose1 and London enable it on both routers and on the Frame Relay interfaces. An example of enabling it on an interface is shown below:

```
SanJose1(config)#interface serial 0/0
SanJose1(config-if)#cdp enable
```

After you enable CDP, view SanJose1's routing table again:

```
SanJose1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile,
       B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF
inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external
type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2,
       E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia -
IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

C    192.168.192.0/24 is directly connected, Serial0/0
o    192.168.200.0/24 [160/1] via 192.168.192.2, 00:00:32,
Serial0/0
C    192.168.0.0/24 is directly connected, FastEthernet0/0
I    192.168.1.0/24 [100/120] via 192.168.0.2, 00:01:20,
FastEthernet0/0
```

Note that SanJose1 finally has a route to the London LAN.

2. What is the administrative distance of the ODR route to the London LAN?

---

## Step 5

Finally, verify connectivity with an extended ping from the SanJose2 LAN to the London LAN:

```
SanJose2#ping
Protocol [ip]:
Target IP address: 192.168.200.1
```

```

Repeat count [5]:
Datagram size [100]:
Timeout in seconds [2]:
Extended commands [n]: y
Source address or interface: 192.168.1.1
Type of service [0]:
Set DF bit in IP header? [no]:
Validate reply data? [no]:
Data pattern [0xABCD]:
Loose, Strict, Record, Timestamp, Verbose[none]:
Sweep range of sizes [n]:
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 192.168.200.1, timeout is 2
seconds:
.....
Success rate is 0 percent (0/5)

```

#### 1. Why did the ping fail?

---



---



---

View SanJose2's routing table:

```

SanJose2#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile,
       B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF
inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external
type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2,
       E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2,
       * - candidate default
       U - per-user static route, o - ODR, P - periodic
downloaded static route
       T - traffic engineered route

Gateway of last resort is not set

I    192.168.192.0/24 [100/80135] via 192.168.0.1, FastEthernet0/1
C    192.168.0.0/24 is directly connected, FastEthernet0/1
C    192.168.1.0/24 is directly connected, FastEthernet0/0

```

Even though SanJose1 and SanJose2 are sharing IGRP routes, SanJose1 is not forwarding the route learned through ODR. ODR only works between two routers for a total of one hop. ODR is intended as a low-maintenance way to implement hub-and-spoke topologies where routing protocols may utilize too much bandwidth. ODR is not a true routing protocol, though an ODR route can be redistributed into a routing protocol.

On SanJose1, provide default metrics for IGRP and redistribute ODR routes:

```

SanJose1(config)#router igrp 234
SanJose1(config-router)#default-metric 1000 100 250 100 1500
SanJose1(config-router)#redistribute odr

```

View the routing table on SanJose2 to confirm redistribution, as shown here:

```
SanJose2#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile,
        B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF
        inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external
        type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2,
        E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2,
        * - candidate default
        U - per-user static route, o - ODR, P - periodic downloaded
        static route
        T - traffic engineered route
```

Gateway of last resort is not set

```
I   192.168.192.0/24 [100/80135] via 192.168.0.1, FastEthernet0/1
I   192.168.200.0/24 [100/10110] via 192.168.0.1, FastEthernet0/1
C   192.168.0.0/24 is directly connected, FastEthernet0/1
C   192.168.1.0/24 is directly connected, FastEthernet0/0
```

The London LAN appears as an IGRP route.

## Step 6

The benefit of ODR is apparent as more LANs are created in London. Simulate another LAN in London by creating a loopback interface, as shown here:

```
London(config)#interface loopback 0
London(config-if)#ip address 192.168.208.1 255.255.255.0
```

Now view SanJose2's routing table:

```
SanJose2#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile,
        B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF
        inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external
        type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2,
        E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2,
        * - candidate default
        U - per-user static route, o - ODR, P - periodic downloaded
        static route
        T - traffic engineered route
```

Gateway of last resort is not set

```
I   192.168.192.0/24 [100/80135] via 192.168.0.1, FastEthernet0/1
I   192.168.200.0/24 [100/10110] via 192.168.0.1, FastEthernet0/1
I   192.168.208.0/24 [100/10110] via 192.168.0.1, FastEthernet0/1
C   192.168.0.0/24 is directly connected, FastEthernet0/1
C   192.168.1.0/24 is directly connected, FastEthernet0/0
```

Note that the new network, 192.168.208.0/24 is dynamically added to both San Jose routers' tables.