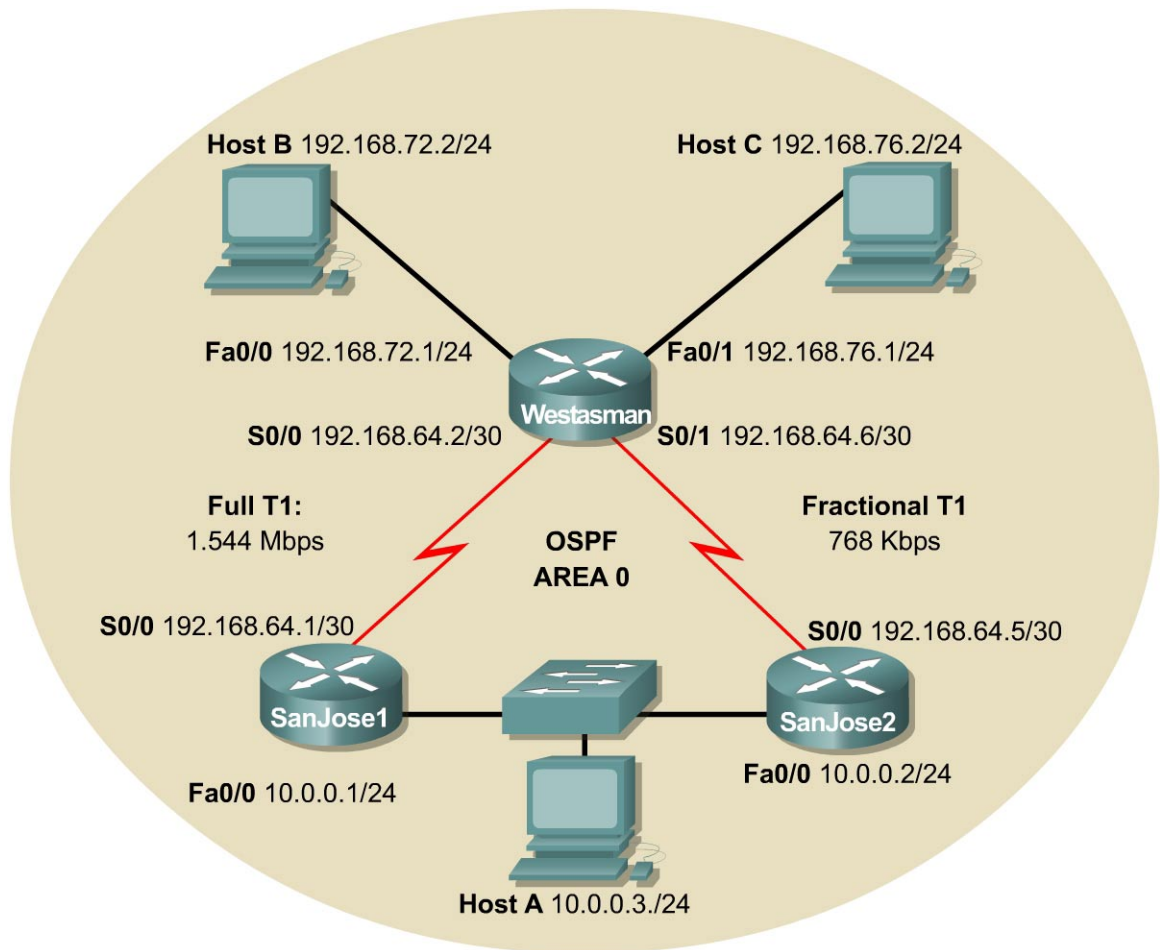


## Lab 8.5.2a Configuring Route Maps



### Objective

In this lab, apply a routing policy by configuring a route map.

### Scenario

International Travel Agency maintains two WAN links from the West Tasman site to its core network 10.0.0.0/24. West Tasman is also referred to as Westasman. One link is full T1 or 1.544 Mbps. The other link is a fractional T1 with a capacity of 768 Kbps. Under OSPF, West Tasman prefers the Full T1 link by virtue of its higher bandwidth and lower cost. All traffic that originates from the 192.168.72.0/24 network that is destined for the 10.0.0.0/24 network needs to be routed through the fractional T1 link. This T1 link has a Crypto Box allowing encryption and improved security. Apply this policy by configuring a route map on the West Tasman router.

## Step 1

Build and configure the network according to the diagram. Insure that the bandwidth for each serial interface listed above is set to 1544kbps. Do not configure the link between Westasman and SanJose2 as a fractional T1 yet. WIC 2T and standard serial interfaces will default to 1544k. Serial interfaces that are Sync/Async will default to 128k. If using a WIC 2A/S in one of the lab routers, be sure to adjust the bandwidth initially to 1544. Configure all interfaces for OSPF Area 0. Configure Host A and Host B with IP addresses and default gateways as indicated in the diagram. Initially configure the serial links for equal cost share. That is, do not configure the serial link bandwidth statements at this time.

**Note:** Use SanJose1 as the gateway of HostA.

Use **ping** and **show ip route** to verify the work and test connectivity between all interfaces and hosts.

## Step 2

Check the routing table on Westasman as follows:

```
Westasman#show ip route
Gateway of last resort is not set

C    192.168.72.0/24 is directly connected, FastEthernet0/0
C    192.168.76.0/24 is directly connected, FastEthernet0/1
     192.168.64.0/30 is subnetted, 2 subnets
C      192.168.64.0 is directly connected, Serial0/0
C      192.168.64.4 is directly connected, Serial0/1
     10.0.0.0/24 is subnetted, 1 subnets
O      10.0.0.0 [110/65] via 192.168.64.1, 00:00:17, Serial0/0
                   [110/65] via 192.168.64.5, 00:00:17, Serial0/1
```

1. How many routes does Westasman have to 10.0.0.0/24?
- 

Two equal cost routes are in the routing table.

Configure S0/1 on Westasman and S0/0 on SanJose2 to accurately reflect the bandwidth of the WAN link as follows:

```
Westasman(config)#interface serial0/1
Westasman(config-if)#bandwidth 768
Westasman(config)#interface serial0/0
Westasman(config-if)#bandwidth 1544
```

After setting the bandwidth, check the routing table on Westasman as follows:

```
Westasman#show ip route
Gateway of last resort is not set
C    192.168.72.0/24 is directly connected, FastEthernet0/0
C    192.168.76.0/24 is directly connected, FastEthernet0/1
     192.168.64.0/30 is subnetted, 2 subnets
C      192.168.64.0 is directly connected, Serial0/0
C      192.168.64.4 is directly connected, Serial0/1
     10.0.0.0/24 is subnetted, 1 subnets
O      10.0.0.0 [110/65] via 192.168.64.1, 00:00:01, Serial0/0
```

2. How many routes are there to 10.0.0.0/24?
- 
3. Which interface is OSPF using to route to 10.0.0.0/24?
-

Westasman should have one route to the core FastEthernet network using S0/0. OSPF uses bandwidth to derive cost for each route. With unequal costs, only the preferred lower cost route is placed in the routing table.

### Step 3

Configure a route map to force Westasman to use S0/1 to route traffic from 192.168.72.0/24 bound for 10.0.0.0/24. Before configuring the route map, create an access list that will match the traffic that needs to be policy routed. Because traffic sourced from 192.168.72.0/24 is to be affected, create the following access list on Westasman:

```
Westasman (config)#access-list 101 permit ip 192.168.72.0 0.0.0.255
10.0.0.0 0.0.0.255
```

Next, create the route map, which will be called CRYPTO. The route map will reference access list 101, which was just created. Use the following commands:

```
Westasman(config)#route-map CRYPTO permit 10
Westasman(config-route-map)#match ip address 101
Westasman(config-route-map)#set interface serial 0/1
```

This policy will be applied to the FastEthernet 0/0 of Westasman, because this is the interface that will accept the traffic that is to be policy routed. On FastEthernet 0/0, enter the following commands:

```
Westasman(config)#interface fastethernet 0/0
Westasman(config-if)#no ip route-cache
Westasman(config-if)#ip policy route-map CRYPTO
```

Route map CRYPTO is now applied to FastEthernet 0/0. To verify this, issue the

**show ip interface fastethernet 0/0** command as follows:

```
Westasman#show ip interface fastethernet 0/0
FastEthernet0/0 is up, line protocol is up
  Internet address is 192.168.72.1/24
  Broadcast address is 255.255.255.255
  Address determined by setup command
  MTU is 1500 bytes
  Helper address is not set
  Directed broadcast forwarding is disabled
  Multicast reserved groups joined: 224.0.0.5 224.0.0.6
  Outgoing access list is not set
  Inbound access list is not set
  Proxy ARP is enabled
  Security level is default
  Split horizon is enabled
  ICMP redirects are always sent
  ICMP unreachable are always sent
  ICMP mask replies are never sent
  IP fast switching is disabled
  IP fast switching on the same interface is disabled
  IP Flow switching is disabled
  IP Feature Fast switching turbo vector
  IP multicast fast switching is enabled
  IP multicast distributed fast switching is disabled
  IP route-cache flags are Fast
  Router Discovery is disabled
  IP output packet accounting is disabled
  IP access violation accounting is disabled
  TCP/IP header compression is disabled
  RTP/IP header compression is disabled
  Probe proxy name replies are disabled
  Policy routing is enabled, using route map CRYPTO
  Network address translation is disabled
  WCCP Redirect outbound is disabled
```

```
WCCP Redirect inbound is disabled
WCCP Redirect exclude is disabled
BGP Policy Mapping is disabled
```

Another simple way to verify that the route-map is properly applied to the interface is to issue the **show ip policy** command. The output is displayed as follows:

```
Westasman#show ip policy
Interface      Route map
Fa0/0          CRYPTO
```

After this configuration is completed, use **show ip route** to verify that S0/0 is still the exit interface for router Westasman to network 10.0.0.0/24.

#### Step 4

Verify that the policy has taken effect. Issue the **debug ip policy** command at the Westasman console. Leave this window open or issue the **logging buffered** command.

```
Westasman#debug ip policy
Westasman#config t
Westasman(config)#logging buffered
```

From Host B, use a trace route program, such as **tracert**, to trace the route to 10.0.0.1.

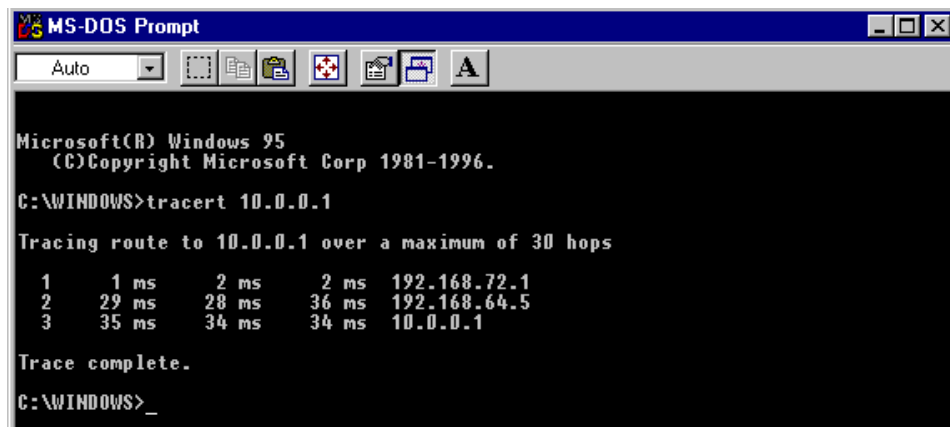
During the trace, the output from the **debug ip policy** command should be seen, indicating that packets are being policy routed. If the output from the Westasman router was not visible, then issue **show logging** to see the output. Using either approach should display output that is similar to the following:

```
01:02:06: IP: s=192.168.72.2 (FastEthernet0/0), d=10.0.0.1, len
78, policy match 01:02:06: IP: route map CRYPTO, item 10, permit

01:02:06: IP: s=192.168.72.2 (FastEthernet0/0), d=10.0.0.1
(Serial0/1), len 78, policy routed
```

Examine the output from the trace route of Host B.

1. Did this trace hop through 192.168.64.5?



```
MS-DOS Prompt
Auto
Microsoft(R) Windows 95
(C)Copyright Microsoft Corp 1981-1996.
C:\WINDOWS>tracert 10.0.0.1

Tracing route to 10.0.0.1 over a maximum of 30 hops

  0  1 ms    2 ms    2 ms   192.168.72.1
  1  29 ms   28 ms   36 ms   192.168.64.5
  2  35 ms   34 ms   34 ms   10.0.0.1

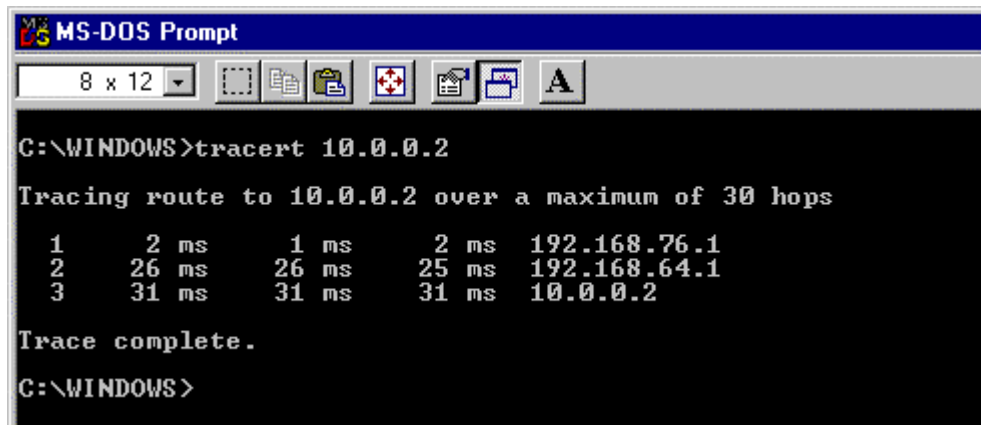
Trace complete.
C:\WINDOWS>
```

The next hop should have been 192.168.64.5.

2. From which of the interfaces of Westasman did this packet exit?

The exit interface should have been S0/1.

From Host C, use a trace route program to trace the route to 10.0.0.2 and examine the output from the trace route.



```
MS-DOS Prompt
8 x 12
C:\WINDOWS>tracert 10.0.0.2

Tracing route to 10.0.0.2 over a maximum of 30 hops

  1      2 ms      1 ms      2 ms    192.168.76.1
  2     26 ms     26 ms     25 ms    192.168.64.1
  3     31 ms     31 ms     31 ms    10.0.0.2

Trace complete.
C:\WINDOWS>
```

3. Did this trace hop through 192.168.64.1?

---

4. From which of the interfaces of Westasman did this packet exit?

---

The ICMP packets of Host C took a different route to network 10.0.0.0/24. The Host C IP address was denied by the access list associated with the route map. It was not permitted to be policy routed.

Finally, issue the **show route-map** command on Westasman as follows:

```
Westasman#show route-map CRYPTO
route-map CRYPTO, permit, sequence 10
Match clauses:
  ip address (access-lists): 101
Set clauses:
  interface Serial0/1
Policy routing matches: 33 packets, 4149 bytes
```

5. How many packets have been matched for policy routing?

---

## Step 5

1. Is the network configuration finished?

---

Security can be easily compromised if return traffic to the 192.168.72.0/24 network is not returned through the link with the Crypto Box. The following commands will complete the scenario.

On router SanJose1 create a route-map named RETURN\_TRAFFIC that will route all traffic coming from the 10.0.0.0/24 network to the SanJose2 next hop IP address 10.0.0.2.

```
SanJose1(config)#route-map RETURN_TRAFFIC permit 10
```

```
SanJose1(config-route-map)#match ip address 101
SanJose1(config-route-map)#set interface fastethernet 0/0
SanJose1(config-route-map)#set ip next-hop 10.0.0.2
```

Create the access list that is referenced in the above route map.

```
SanJose1(config)#access-list 101 permit ip 10.0.0.0 0.0.0.255 192.168.72.0
0.0.0.255
```

Activate this route map by issuing the following commands:

```
SanJose1(config)#interface fastethernet 0/0
SanJose1(config-if)#no ip route-cache
SanJose1(config-if)#ip policy route-map RETURN_TRAFFIC
```

Verify that the route map is active with the `show ip policy` or `show ip interface fastethernet 0/0` command as follows:

```
SanJose1#show ip policy
Interface      Route map
Fa0/0          RETURN_TRAFFIC

SanJose1#show ip interface fastethernet 0/0
FastEthernet0/0 is up, line protocol is up
  Internet address is 10.0.0.1/24
  Broadcast address is 255.255.255.255
  Address determined by setup command
  MTU is 1500 bytes
  Helper address is not set
  Directed broadcast forwarding is disabled
  Multicast reserved groups joined: 224.0.0.5 224.0.0.6
  Outgoing access list is not set
  Inbound access list is not set
  Proxy ARP is enabled
  Security level is default
  Split horizon is enabled
  ICMP redirects are always sent
  ICMP unreachable are always sent
  ICMP mask replies are never sent
  IP fast switching is disabled
  IP fast switching on the same interface is disabled
  IP Flow switching is disabled
  IP Feature Fast switching turbo vector
  IP multicast fast switching is enabled
  IP multicast distributed fast switching is disabled
  IP route-cache flags are Fast
  Router Discovery is disabled
  IP output packet accounting is disabled
  IP access violation accounting is disabled
  TCP/IP header compression is disabled
  RTP/IP header compression is disabled
  Probe proxy name replies are disabled
  Policy routing is enabled, using route map RETURN_TRAFFIC
  Network address translation is disabled
  WCCP Redirect outbound is disabled
  WCCP Redirect inbound is disabled
  WCCP Redirect exclude is disabled
  BGP Policy Mapping is disabled
```

## Step 6

Insure that the SanJose2 router does not send the route request back to the SanJose1 router. To do so, create a policy that will override the routing table on SanJose2. To complete this requirement, issue the following commands:

```
SanJose2(config)#route-map RETURN_TRAFFIC permit 10
SanJose2(config-route-map)#match ip address 101
```

```
SanJose2(config-route-map)#set interface serial 0/0
```

Create the access list that is referenced in the above route map.

```
SanJose2(config)#access-list 101 permit ip 10.0.0.0 0.0.0.255 192.168.72.0  
0.0.0.255
```

Activate this route map by issuing the following commands:

```
SanJose2(config)#interface fastethernet 0/0  
SanJose2(config-if)#no ip route-cache  
SanJose2(config-if)#ip policy route-map RETURN_TRAFFIC
```

Verify that the route map is active with the **show ip policy** or **show ip interface fastethernet 0/0** command as follows:

```
SanJose2#show ip policy  
Interface      Route map  
Fa0/0          RETURN_TRAFFIC  
  
SanJose2#show ip interface fastethernet 0/0  
FastEthernet0/0 is up, line protocol is up  
  Internet address is 10.0.0.2/24  
  Broadcast address is 255.255.255.255  
  Address determined by setup command  
  MTU is 1500 bytes  
  Helper address is not set  
  Directed broadcast forwarding is disabled  
  Multicast reserved groups joined: 224.0.0.5 224.0.0.6  
  Outgoing access list is not set  
  Inbound access list is not set  
  Proxy ARP is enabled  
  Security level is default  
  Split horizon is enabled  
  ICMP redirects are always sent  
  ICMP unreachable are always sent  
  ICMP mask replies are never sent  
  IP fast switching is enabled  
  IP fast switching on the same interface is disabled  
  IP Flow switching is disabled  
  IP Feature Fast switching turbo vector  
  IP multicast fast switching is enabled  
  IP multicast distributed fast switching is disabled  
  IP route-cache flags are Fast  
  Router Discovery is disabled  
  IP output packet accounting is disabled  
  IP access violation accounting is disabled  
  TCP/IP header compression is disabled  
  RTP/IP header compression is disabled  
  Probe proxy name replies are disabled  
  Policy routing is enabled, using route map RETURN_TRAFFIC  
  Network address translation is disabled  
  WCCP Redirect outbound is disabled  
  WCCP Redirect inbound is disabled  
  WCCP Redirect exclude is disabled  
  BGP Policy Mapping is disabled
```

## Step 7

Verify that the router maps are active. Does each router enforce the policy when a **ping** originates from host 192.168.72.2 that is destined for host 10.0.0.3?

The following output was collected from router SanJose2:

```
02:34:27: IP: s=10.0.0.3 (FastEthernet0/0), d=192.168.72.2, len 100, policy match  
02:34:27: IP: route map RETURN_TRAFFIC, item 10, permit  
02:34:27: IP: s=10.0.0.3 (FastEthernet0/0), d=192.168.72.2 (Serial0/0), len 100,  
policy routed
```