LAB 7

PBR and MPLS

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Create following loopbacks on each of the router and assign the IP addresses as shown:

R6: 30.0.0.6, 30.0.0.7, 30.0.0.8

R1: 30.0.0.1

R2: 30.0.0.2

R3: 30.0.0.3

R4: 30.0.0.4

R5: 30.0.0.5, 30.0.0.11, 30.0.0.12

**Objective 1: Setting up the topology**

1. Run a dynamic routing protocol in the topology, advertise all loopbacks as /32
2. Confirm that all loopbacks are reachable from one another and note down the paths taken. Paste all screenshots

**Objective 2: Policy based routing**

1. 30.0.0.6 should first go to R3 before going to any of the loopbacks on R5 (except loopbacks on R1 and R6). Return path should also follow the same
2. The traffic from 30.0.0.8 to 30.0.0.11 should follow the path of R6-R1-R4-R3-R2-R5. And vice versa for the reverse path.

**Objective 3: Understanding LDP operation**

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**Step 1**

Shut down/Delete the loopback interfaces.

**Step2**

Enable MPLS and LDP on all routers.

In the global config mode,

*mpls label protocol ldp mpls ip*

*ip cef*

In the interface config mode, *mpls ip*

**Step 3**

Do not run any static or dynamic routing protocol (Remove the IGP or static routes that were running in previous objective).

**Questions:**

1. Explain the commands used in step 2.
2. Did any of the routers form LDP neighbors? If so, mention the routers that are LDP neighbors. 3.
3. Explain why other routers could not form LDP neighbors. (Hint: Check the LDP ID’s used by each of the router and the reachability to the LDP ID’s)
4. Explain how LDP neighbors are discovered and maintained with necessary logs. Include protocol messages, transport protocol and port numbers. (debug mpls ldp and wireshark would suffice)
5. How can you achieve all the LDP neighborships in the topology? Do you need a routing protocol to achieve it?

**Step 4**

Now create loopback interfaces as mentioned in the topology and enable MD5 authentication between all LDP neighbors.

**Step 5**

Enable an optimal routing protocol to achieve end to end connectivity. You need to perform label switching and MPLS Traffic Engineering.

**Questions:**

6. What are the local and remote label bindings at R1? How are the local label bindings advertised to neighbors? Show relevant debug output.

7. What is the remote label bindings at R2 and R3 for the network 30.0.0.1/32? Is it the same or different? Explain why?

8.What label does R1 assign to the network 30.0.0.1? Does R2 use a label to forward packets to

30.0.0.1 on a steady state? Explain why or why not? (Hint: Compare “sh mpls forwarding table”, “sh ip route” and “sh mpls ldp bindings”). Shut down the link between R1 and R2 and explain whether R2 would use labels to reach 30.0.0.1?

9.Bring up the link R1-R2. What is the outgoing label used by R4 to forward a packet to 30.0.0.1 network? How many label switched paths does R4 have to reach 30.0.0.1 network?

1. Do all the label bindings in the LIB go in to the LFIB table? Explain which mappings enter the LFIB table? Provide necessary logs to support your answer.
2. What is the current LDP hold time and keep alive interval? Paste relevant configuration snippets.
3. Ping 30.0.0.4 from R1 and answer the following questions:
   1. How many label switched paths exist from R1 to reach 30.0.0.4? (Hint: sh ip route and sh mpls forwarding-table)
   2. Which path does your ping request use? Does it use both the paths? If not explain why?
   3. What is the penultimate router for the ping request you just sent? What operation did the penultimate router perform? (Swap/push/pop)
   4. Is PHP (Penultimate hop popping) enabled by default?
   5. Is there a counter to see how many bytes of packet has been label switched? Paste relevant show commands.
4. Shut down any interface on R1 and no shut after a few seconds. Explain the sequence of events that occur. Is routing protocol convergence required before LDP neighbors can be formed?