

MPLS L1 2021

Introduction

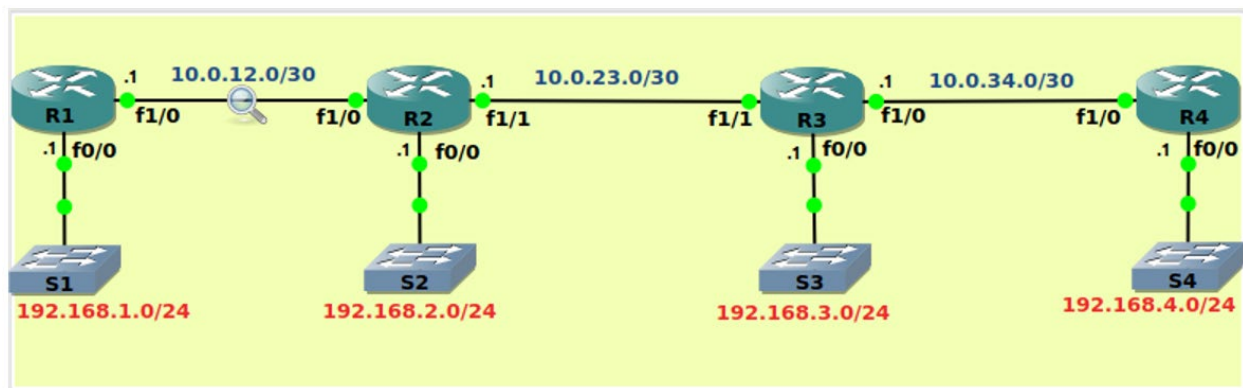
The objective of this lab is to learn the **functioning mechanics of an MPLS core**. Information will be collected during the implementation of a topology that will be used in an analysis to explain **how the MPLS core works**. By the end of this lab, the student should be able to explain:

- How MPLS labels are generated.
- How MPLS labels are exchanged. (Or the functioning of LDP).
- The different types of labels and their meanings.
- How MPLS labels are installed by routers.
- The structure of the MPLS forwarding table.
- The encapsulation of IPv4 packets into MPLS packets.
- The forwarding or switching of packets through the MPLS core.

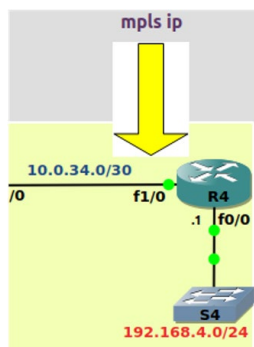
Part 1

Investigation of the mechanics of the MPLS and LDP

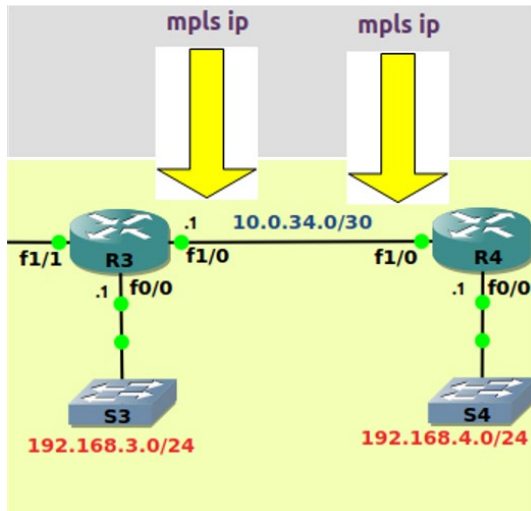
- Build the following topology. This is the core of an MPLS network.
- The IGP is OSPF.
- The loopback addresses have the format 10.r#.r#.r#/32; for example, 10.1.1.1/32
- Verify that every network is reachable from every router before continuing with the next steps.



- In router R4, interface f1/0 enable **mpls ip**.

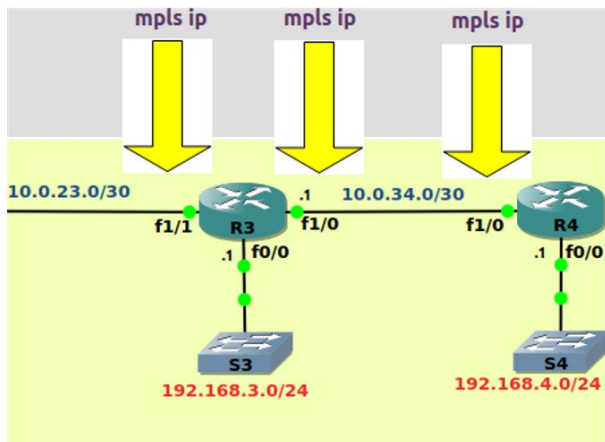


- In R4, run **show mpls forwarding-table**
 - Collect this information and use it for your explanation.
 - What interfaces have labels and why?
 - What interfaces do not have labels and why?
 - What interfaces appear as pop?
 - What is the difference between local and outgoing?
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- Now, enable mpls ip in router R3, interface f1/0



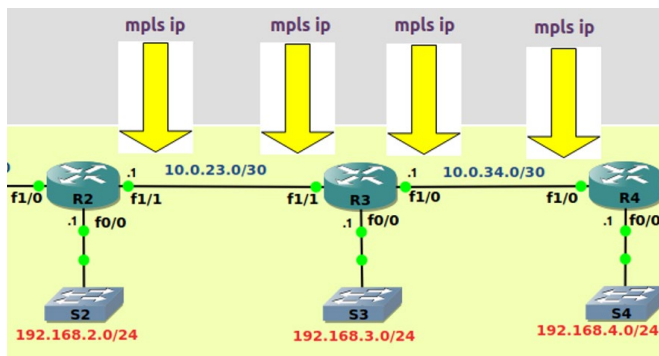
- In R4, run **show mpls forwarding-table**
 - Collect this information and use it for your explanation.
 - Did something change?
 - What interfaces have labels and why?
 - What interfaces do not have labels and why?
 - What interfaces appear as pop?
 - What is local and outgoing?
-
- In R3, run **show mpls forwarding-table**
 - Collect this information and use it for your explanation.
 - What interfaces have labels and why?
 - What interfaces do not have labels and why?
 - What interfaces appear as pop?
 - What is local and outgoing?

- Now, enable mpls ip in router R3, interface f1/1



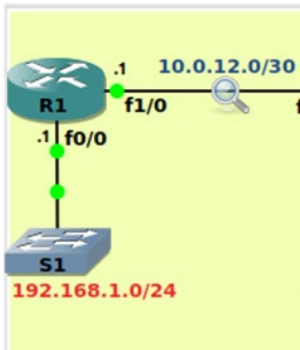
- In R3, run **show mpls forwarding-table**
- Collect this information and use it for your explanation.
- What interfaces have labels and why?
- What interfaces do not have labels and why?
- What interfaces appear as pop?
- What is local and outgoing?

- Now, enable mpls ip in router R3, interface f1/1

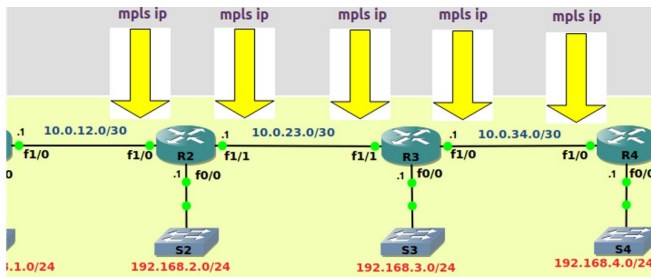


- In R2, run **show mpls forwarding-table**
- Collect this information and use it for your explanation.
- What interfaces have labels and why?
- What interfaces do not have labels and why?
- What interfaces appear as pop?
- What is local and outgoing?

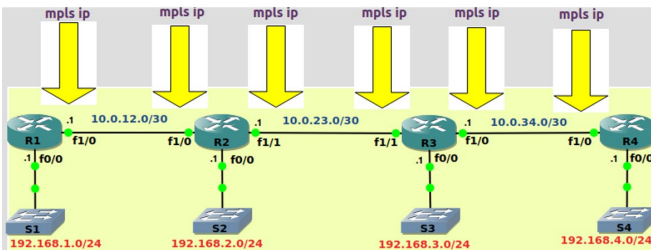
- At this point, sniff in R1's interface f1/0 for LDP. Make sure to capture all the transactions from scratch.



- Now, enable **mpls ip** in router R2, interface f1/0

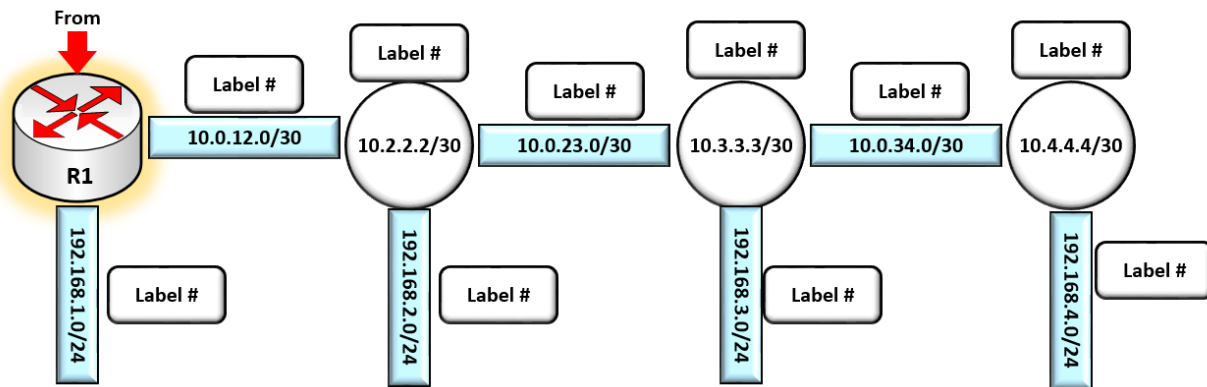


- In R1, run **show mpls forwarding-table**
- Collect this information and use it for your explanation.
- Now, enable **mpls ip** in router R1, interface f1/0



- Repeat run **show mpls forwarding-table**
 - What interfaces have labels and why?
 - What interfaces do not have labels and why?
 - What interfaces appear as pop?
 - What is local and outgoing?
- Wait for a while, stop the sniffer and save the file for analysis.

- Use the knowledge collected from **show mpls forwarding** command to build diagrams (one per router) such as the following (for example):

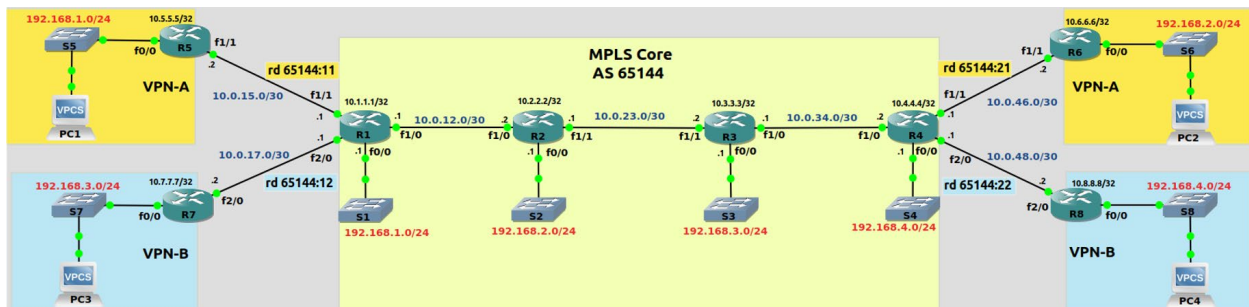


- Make a diagram for every router standpoint.

Part 2

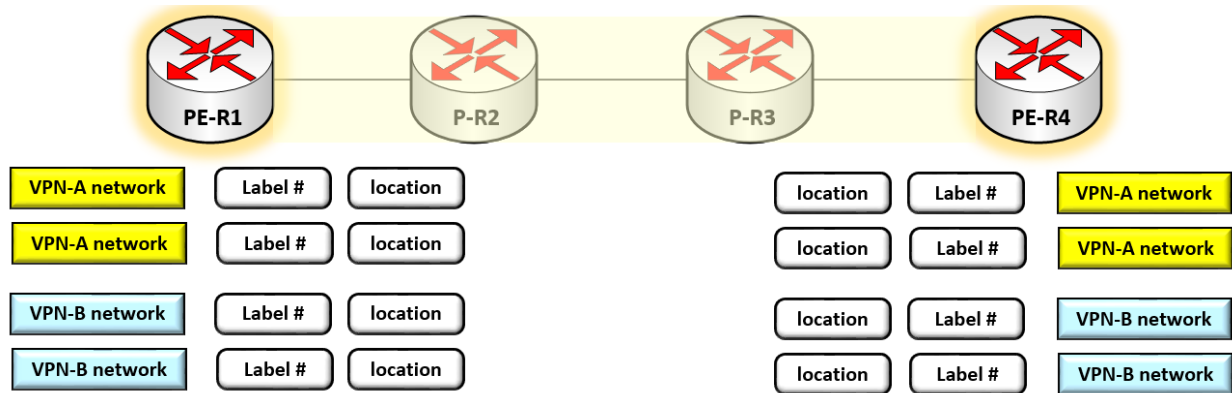
MPLS Layer 3 VPVn4, PE-CE static.

- Complete the topology by adding two customers VPN-A (yellow) and VPN-B (blue).
- The two customers route using static default routing.



- Once that the topology is complete, PC1 must reach PC2 and PC3 must reach PC4.
- Sniff between R1 and R2, R2 and R3, and R3 and R4.
- Now, ping from PC1 to PC2.
- Now, ping from PC3 to PC4.
- Stop all the sniffs and save it them. You have data there to analyze.
- Use these commands to gather more data.
- In R1, **show mpls forwarding-table 10.4.4.4**
- In R2, **show mpls forwarding-table 10.4.4.4**
- In R3, **show mpls forwarding-table 10.4.4.4**

- In PE router R1 and R4, run **show ip bgp vpnv4 all** (use vrf names to see details)
- In PE router R1 and R4, run **show ip bgp vpnv4 all labels** (use vrf names to see details)
- Take such data and make sense out of that. Make something like this:



- Traceroute from R5 to 10.6.6.6. Save such output.
- Traceroute from R5 to 10.5.5.5. Save such output.
- Traceroute from R7 to 10.8.8.8. Save such output.
- Traceroute from R8 to 10.7.7.7. Save such output.

By now, you have all the information collected to do a great analysis about the functioning of the MPLS Layer 3 VPNv4 model and the distribution of labels. The main point is to explain the functioning of the MPLS core and the role of the supporting protocols.

- Submit a professional report where you **explain** the functioning of this MPLS model using the information collected during the lab. **Interpret** the information.