

Lab 4: LDP (Part 2) and MPLS

Or: Export policy for LDP; IGP shortcuts, and Basic RSVP

What you will do:

1. Verify full IGP reachability throughout the network
2. Verify LDP operation throughout the network
3. Configure and apply policy to generate additional labels for desired FECs
4. Configure, demonstrate, and examine LSP and LSP-path creation with RSVP

Things that you will need to know or learn:

1. CLI commands for configuring LDP
2. CLI commands for configuring and applying policy
3. CLI commands for configuring RSVP
4. Appropriate "show" commands to verify all the above configuration

What you need to submit and when:

1. There is no pre-lab for Lab 4.
2. Complete the in-lab part of the exercise (see below), **before** the end of your lab period.
3. Complete the "Lab 4 Post-lab" exercise and submit on BrightSpace, **before** your lab section's assigned due date (Sect A1: **Sat @ 11:59pm**, Sect A2: **Thu @ 11:59pm**)

Required Equipment:

- USB memory stick to save results for post-lab questions
- Hard-cover lab notebook, for reference during SBA at the end of the course.
- PC with internet access, a compatible browser, and terminal program (Provided in T108)

In-Lab Marks:

Each of the items listed below is worth a single mark towards your in-lab score.

- [Lab 3.4] Demo the successful creation and application of policy for additional FEC labels
- Demo of IGP shortcuts using LDP
- Demo of IGP shortcuts operating in Pipe mode and Uniform mode
- Demo of RSVP LSPs running within your pod and between diagonal pods

The in-lab score is worth 50% of the mark for this lab.

The post-lab score is worth 50% of the mark for this lab.

10% of your final mark is for labs done during the course of the semester.

References and Resources:

- MPLS lab guide; lab 3.4
- Lecture summary notes from last week for a template of RSVP LSPs
- NRS II Self-Study Guide, Ch 13 "MPLS Shortcuts for IGP", pp. 644-648
- 7750 SR OS MPLS Guide Ver 12.0, see the sections LDP Shortcuts for IGP Routes (pp. 475-476 in Ver 12.0), and Disabling TTL Propagation in an LSP Shortcut (p. 477 in Ver 12.0)
Tip: google the terms: *7750 SR OS MPLS guide 12.0 site:infoproducts.alcatel-lucent.com*
- MySRLab: remote-access lab facility hosted at Nokia's Kanata campus

Addressing & Login Table

	Edu Lab 1	Edu Lab 2	Edu Lab 3
R1	.164	.196	.228
R2	.165	.197	.229
R3	.166	.198	.230
R4	.167	.199	.231
R5	.168	.200	.232
R6	.169	.201	.233
R7	.170	.202	.234
R8	.171	.203	.235
R9	.172	.204	.236
R10	.173	.205	.237
R11	.174	.206	.238
R12	.175	.207	.239

	My specific login information
EDU Lab # (1, 2, or 3)	
Individual login ID	
Corresponding password	

See BrightSpace for a list of login IDs and passwords; write **yours** in the space above.

Base IP address is: **192.168.206.0/24**

Command Reference

```
configure • router • ldp-shortcut # Enable LSPs globally for IGP routing
configure • router • ldp • [no] shortcut-local-ttl-propagate # choose handling of IP TTL

show • router • tunnel-table
show • router • route-table
```

```
configure • router • mpls • interface {int_name} # Add i/f to protocol; look familiar? (M4, p13)
configure • router • mpls • no shutdown # Important! Turn MPLS ON (Mod 4, p 14)
configure • router • rsvp • no shutdown # Important! Turn RSVP ON
```

[For other **RSVP config commands**, see excellent 1-slide summary in Module 4, slide 17]
[For other **RSVP show commands**, see excellent summary in Module 4, slide 27-32]

Task 1: Verify full IGP (OSPF) and LDP connectivity in the network

Confirm and reconfigure as necessary, all core links working and full OSPF & LDP connectivity between **all 12 routers**, but no ECMP. Use whichever subnets already exist (/27 or /24).

Task 2: Configure policies to generate additional FEC labels

Follow the instructions given in **MPLS Lab 3.4** to generate additional FEC labels (**including** for the outer-most routers, R9-R12). Remember to match the existing mask(s) for the subnets. Be sure to read and answer **all questions** which appear in the lab guide!

Challenge: Is it possible to verify the proper operation of the additional labels using lsp-ping and lsp-trace?

CHECK POINT #1: Be prepared, with output on your screen, to prove the existence of additional FEC labels.

Task 3: Configure & Verify LDP shortcuts for IGP routes

- Step 1. For the sake of clarity and simplicity, it's best to remove the additional LDP FECs that you created in the previous task. Tip: There's a method which takes only a single line of configuration (per router).
- Step 2. [Optional] You may disable ECMP on the core routers if you wish. It may make it easier to see before-and-after differences in behavior with LDP shortcuts.
- Step 3. Display the full routing table. **Copy** and save all your output for any post-lab questions. From your CE router to the other CE & PE routers, run standard ping & traceroute commands to a variety of other routers and save the results. Be sure you understand the number of hops shown by each command.
- Step 4. ONLY on the CE routers, turn on LDP shortcuts for IGP routes (see Command Ref).
- Step 5. Find proof in the routing table of exactly what IGP traffic, if any, will be forwarded via LSPs. **Copy** and save all your output for any post-lab questions. (If necessary, turn off LDP shortcuts, redo your testing from step 3, and then turn LDP shortcuts back on.)
- Step 6. Test carefully between your CE and the diagonally opposite CE & PE routers, using suitable *combinations* of ping and traceroute commands back & forth between routers, to reveal and prove that forwarding is occurring via LSPs. Hint: does testing in one direction yield identical results to testing from the opposite direction?
- Step 7. Prove, by means of the output from suitable *combinations* of ping and traceroute commands, that suitable configuration commands will switch back & forth between pipe and uniform mode for TTL handling. Again, compare the test results in one direction to the opposite direction. Be sure you know which config command activates which tunnel mode!

CHECK POINT #2, #3: Provide proof of successful completion of the last two steps above.

Task 4: Configure Simple (loose) RSVP LSPs

For this task, you need to configure two RSVP LSPs:

- one from your CE to your core router
- one from your PE to the diagonally opposite PE

Adapted from "Lab 4 IGP-based RSVP LSP Establishment" in Nokia's MPLS Lab manual

- Step 1. Follow the model provided in this week's lecture notes and/or Module 4, slides 13-17 to create the two RSVP LSPs.
- Step 2. Use suitable ping and trace commands to verify the operation of your LSPs.

Challenge question: What signs, if any, can you detect of interference between LDP and RSVP LSPs? Hint: What command(s) can you use to test whether both are operating correctly?

CHECK POINT #4: Provide proof that you have two operational RSVP LSPs.

Help any of your classmates who haven't yet succeeded in getting all the tasks completed.