

## 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 BB, **before** your next lab period.

### 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 browser, Java, 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 33% of the mark for this lab.

The post-lab score is worth 66% 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 this week
- 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: use google to search 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
R1	192.168.206.164	192.168.206.196
R2	192.168.206.165	192.168.206.197
R3	192.168.206.166	192.168.206.198
R4	192.168.206.167	192.168.206.199
R5	192.168.206.168	192.168.206.200
R6	192.168.206.169	192.168.206.201
R7	192.168.206.170	192.168.206.202
R8	192.168.206.171	192.168.206.203
R9	192.168.206.172	192.168.206.204
R10	192.168.206.173	192.168.206.205
R11	192.168.206.174	192.168.206.206
R12	192.168.206.175	192.168.206.207

Edu Lab 1 Login	Passwd	Edu Lab 2 Login	Passwd
src-otti01u1		src-otti02u1	
src-otti01u2		src-otti02u2	
src-otti01u3		src-otti02u3	
src-otti01u4		src-otti02u4	
src-otti01u5		src-otti02u5	
src-otti01u6		src-otti02u6	
src-otti01u7		src-otti02u7	
src-otti01u8		src-otti02u8	

See Blackboard for a list of passwords; write **yours** in the space above.

## Command Reference

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

- 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.