

Lab 6 Postlab: RSVP for tunnelling IGP & LDP

Or: Stitching together the best of both worlds

What you will do:

1. Configure RSVP throughout multiple areas
2. Configure RSVP shortcuts for IGP
3. Configure T-LDP sessions in each of three areas, which allow the use of tunnels
4. Configure RSVP tunnelling for LDP
5. Verify end-to-end LDP tunnels and examine the associated label bindings
6. Save configs & enter your answers for each task on BrightSpace

Things that you will need to know or learn:

1. CLI commands for configuring LDP and RSVP (see especially MPLS labs 5.3)
2. CLI commands for using LDP tunnels, and enabling LDP-over-RSVP
3. Reference: material in section 14.8 LDP-over-RSVP, **pp. 740-748 in NRS-II** textbook

What you need to submit and when:

1. Complete the “Lab 6 Post-lab” exercise on BrightSpace with answers from your work, **before** your lab section's assigned due date.

Required Equipment:

- Credentials for booking a MySRLab session
- An actual MySRLab booking
- A PC with internet access and terminal program; eg. Putty (provided by you)

Marks:

This post lab is worth 65% of the mark for Lab 6.

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

References and Resources:

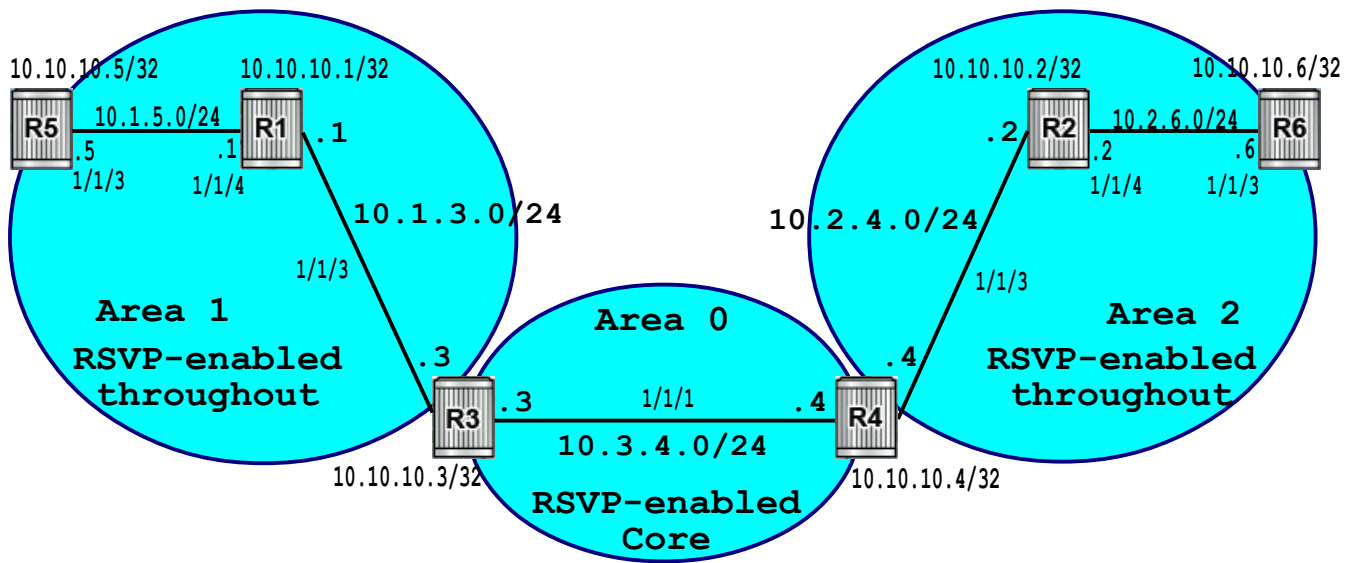
- Command references provided in previous labs
- new LDP and OSPF (!) configuration commands provided in this lab (below)
- MySRLab: remote-access lab facility hosted at the Alcatel-Lucent Kanata campus
- 7750 SR OS Command Reference Guides for MPLS and Routing Protocols

Tip: check BrightSpace or use google to search the terms:

7750 SR OS routing protocols guide 12.0 site:infoproducts.alcatel-lucent.com

Topology

This is the MySRLab network topology that is used for this lab. It is similar to the top half of the Edu topology from the weekly in-lab. **NOTE:** that **only some** links are configured and activated!



Addressing Table for MySRLab Practice Labs

ALL routers are IPv4 addresses in the range **192.168.X.Y** with **X.Y** as given in the table below.

	PL3	PL4	PL5	PL6	PL7	PL8
R1	188.4	188.36	188.68	188.100	188.132	188.164
R2	188.5	188.37	188.69	188.101	188.133	188.165
R3	188.6	188.38	188.70	188.102	188.134	188.166
R4	188.7	188.39	188.71	188.103	188.135	188.167
R5	188.8	188.40	188.72	188.104	188.136	188.168
R6	188.9	188.41	188.73	188.105	188.137	188.169
PC1	188.10	188.42	188.74	188.106	188.138	188.170

The Ixia tester PC is accessed via the Remote Desktop Protocol (RDP), with clients available for Windows (built-in as "mstsc.exe"), Linux (rdesktop), and OSX (<http://cord.sourceforge.net/>)

Practice Lab	User ID	Password
PL3	See pages 4-5 of the <i>MySRLab Technical Primer</i> and page 8 of the <i>MySRLab Getting Started Guide</i> (available on BrightSpace) for connectivity & login details.	
PL4		
PL5		
PL6		
PL7		
PL8		



Command Reference

```
configure • router • ldp • targeted-session • peer x.x.x.x
configure • router • ldp • targeted-session • peer x.x.x.x • tunneling # create tunnel-in-tunnel

configure • router • ldp-shortcut # allow IGP tunneling over LDP
configure • router • ospf • rsvp-shortcut # allow IGP tunneling over RSVP
configure • router • ospf • ldp-over-rsvp # allow IGP tunneling over LDP-over-RSVP

configure • router • ldp • no shortcut-local-ttl-propagate # Pipe mode for LDP shortcuts
configure • router • mpls • no shortcut-local-ttl-propagate # Pipe mode for RSVP shortcuts
```

Task 1: Configure the IGP base topology

You'll notice that the base topology is **identical** to Postlab 2 – Multi-area OSPF. If you followed the directions from week 2, you can simply restore those configs. If not, you'll need to re-configure according to that postlab.

- As per Postlab 2, *system* interfaces for R3-R4 are in area 0
- All other system interfaces are in their respective OSPF areas
- Verify your configuration:
 - Test by pinging to ensure you have full end-to-end IP reachability
 - Verify that every router has **11 routes** in the routing table

Task 2: Enable RSVP-TE on all routers

Prepare for LDP-over-RSVP by configuring RSVP-TE on all routers. You should review Lab 5.3 (and possibly other labs) to ensure you know what's required and how to confirm your work!

- Step 1. Configure and enable RSVP and TE on all routers.
- Step 2. Double check that you've configured everything that's required!
- Step 3. View the status of RSVP with **show router rsvp status** Save the output.
- Step 4. Check the RSVP *neighbors* for R3 (... you should be able to find a suitable command!); save the output to answer the question below.

Questions to answer:

- What is the best command to confirm TE is enabled locally?
- How many type 10 LSAs exist in area 1 or 2? Is zero (0) an acceptable answer?
- In total, how many type 10 LSAs appear in the database for either of the routers in area 0 (eg. R3 or R4)? Is zero (0) an acceptable answer?
- How many of the 10 LSAs on R3 are duplicates of R1? Why?
- In the RSVP status, what value appears for requesting Implicit Null labels?
- How many RSVP neighbors does R3 have? Is zero (0) an acceptable answer?
- What *local* and *remote* capabilities are configured by default on SR OS for Refresh Reduction, Message-ID (Msg-ID), and Reliable Delivery (Ack)?

Task 3: Configure RSVP-TE LSPs across all areas

Add to the supporting infrastructure by configuring LSPs from edge-to-edge, in both directions, across all three areas in the topology. The LSP paths may be totally loose, and should have CSPF enabled.

Step 1. Keep track of the specific order in which you create the LSPs (just simple notes).

Step 2. Once all LSPs are up/up, on each of R5, R3, R4, R6 (area edges) run & capture:

```
show router rsvp session
```

```
show router mpls lsp
```

```
show router tunnel-table
```

Don't forget to include hostname info for each output so that you can identify it!

Step 3. Check the RSVP neighbors for R3; save the output to answer the question below.

Questions to answer:

- For any individual uni-directional LSP, is the **tunnel-id** shown at both ends the same?
- For any individual uni-directional LSP, is the **tunnel-id** identical in all 3 commands?
Can you detect a pattern between the order of creating LSPs (on a given router) and their assigned **tunnel-id**?
- How many RSVP neighbors does R3 have? Is zero (0) an acceptable answer?

Task 4: Demo of **USING** RSVP shortcuts for IGP

With RSVP LSPs already in place, it's super quick & easy to demo RSVP shortcuts for IGP.

Step 1. On **R5**, display and save the routing table. Note in particular the route for R3.

Step 2. On **R5**, traceroute & ping R3; save the output. Note how many hops for each.

Step 3. On **R5**, enable RSVP shortcuts for the IGP

Step 4. On **R5**, again display and save the routing table. Note any next-hop interfaces and metrics that have changed. Can you **correlate** the new output with info from **task 3**??

Step 5. On **R5**, traceroute to R3. How many hops are visible? Save your results.

Step 6. On **R5**, disable propagation of the TTL from IP header -> labels for RSVP shortcuts.

Step 7. On **R5**, traceroute to R3 again. How many hops now?

Step 8. On **R5**, restore the default behavior: enable propagation of the TTL to RSVP labels.

Step 9. On **R5**, ping R3 and save the output. How many routers does the *reply* go **through**?

Step 10. Given the differences in the routing table, is the ping response what you expected?

Step 11. Think about it some more. Wait; maybe think a little more. Now, where do RSVP shortcuts need to be applied in order for a difference in ping response to be visible?!!

Step 12. Test your guess(es) until you get it right.

Step 13. **Remove all RSVP shortcuts** for IGP so that it doesn't obscure the next results.

Questions to answer:

- From R5, what is the OSPF metric to reach R3?
- After applying RSVP shortcuts, has the metric for R3 changed? If so, to what value?
- **Where** do RSVP shortcuts need to be applied for results to be visible on R5?
- With RSVP shortcuts, how many routes are tunnelled?
- With RSVP shortcuts, how many routes have a new egress interface (Next Hop)?
- With RSVP shortcuts, how many routes have a new metric?
- Are RSVP shortcuts used only for the tail-end, or even destinations beyond the tail-end?

Task 5: Demo of LDP-over-RSVP

In this task, we'll configure T-LDP sessions and *activate* them for use over RSVP.

- Step 1. Similar to the in-lab work, configure (reciprocal) T-LDP sessions between routers at the boundary of each area (R5-R3, R3-R4, R4-R6). Be sure to use the "tunneling" parameter in every peering definition.
- Step 2. Using the built-in help functionality, what is the exact meaning given to the term "tunneling" for T-LDP peering? Capture and save the help output.
- Step 3. On **R3**, display and save the list of all LDP bindings and all active bindings. How many of each are there? Are there active bindings for any FEC outside of OSPF areas of which R3 is a member? (Double check your answer by looking at R5 active bindings.)
- Step 4. On **R3**, display the RSVP sessions. Now compare the identifiers: do the "LspId" values for LDP bindings correlate to RSVP "LSP ID" or some other identifier?
- Step 5. On **R5**, display and save: LDP bindings; active LDP bindings; router tunnel-table. Look for a label to reach R4. Look carefully: Is it in use? Is there an exact match in the routing table (same FEC and *same egress next hop*)? Why is or isn't it in use?
- Step 6. **CREATE**: On **R5** only, enable LDP over RSVP: `ospf ldp-over-rsvp` Re-do & save the 3 commands and compare the number of LDP bindings and tunnels available on R5. How far can R5 go over LDP tunnel(s), where each LDP label swap is a "single" hop away?
- Step 7. Enable LDP over RSVP everywhere. Again, capture & compare the 3 commands for R5, and also for R3.
- Step 8. Feel free to run some oam lsp-ping and lsp-trace tests throughout the network. You should have full MPLS reachability to every router participating in LDP. You'll find at this point in time, all hops are revealed in an lsp-trace.
- Step 9. **USE**: Now **activate** the full power of LDP-over-RSVP: on R5, enable `ldp-shortcuts` and disable uniform mode for shortcuts (see cmd ref). On R5, display and save the routing table; run a (ordinary) traceroute to the far end of the network, and other points in between. Is this a little more convincing of LDP-over-RSVP being active?

Questions to answer:

- What does LDP *tunneling* mean?
- By default, did routers have active LDP bindings outside their OSPF member area(s)?
- On R5, how many tunnels existed without LDP-over-RSVP (ie. before it's enabled)? "Who" were the owner(s) of the tunnel(s)?
- With LDP-over-RSVP only on R5, how many tunnels exist? How far could R5 reach?
- On R5, how many tunnels exist with LDP-over-RSVP everywhere? What's R5's reach?
- In which scenario (step 5, 6, 7) could R5 reach R1 and R2 via tunnel(s)? Why or why not?
- What is the exact indication in the routing table that LDP-over-RSVP is now enabled? (Omit any specific tunnel ID values from the answer.)

Task 6: Save all your configs

As always, **save your final configs** so that you can refer to them later for practice and study.

save: `admin save ftp://{mySRLabAlphaLogin}:{assignedPswd}@mysrlab/STD/Rx/Lab6.cfg`

verify: `file dir ftp://{mySRLabAlphaLogin}:{assignedPswd}@mysrlab/STD/Rx/`

