

The following notes for the NET3012-IP Architectures and Solutions course are based on the Nokia MPLS (p/n 3HE02276AA) and Nokia Services Architecture (p/n 3HE02277AA) courses from the Nokia Service Routing Certification Program curriculum. These are copyrighted products of Nokia.

Lab 2 Postlab: Multi-area OSPF

Or: Simple multi-area, ASBR, Stub, Totally stubby, NSSA

What you will do:

1. Configure single area OSPF in MySRLab, including system interfaces
2. Count single-area total routes, and total of each type of LSA (1, 2, 3, 4, 5, 7)
3. Configure multi-area OSPF, including system interfaces
4. Count multi-area total routes, and total of each type of LSA (1, 2, 3, 4, 5, 7)
5. Configure each of ASBR, Stub, Totally stubby, and NSSA areas
6. For each area type, count total routes, and total of each type of LSA (1, 2, 3, 4, 5, 7)
7. Save configs & answer questions about the counts on Blackboard

Things that you will need to know or learn:

1. Topology of the Nokia lab infrastructure (see next page)
2. CLI commands for configuring ports, interfaces, and the system interface
3. Additional CLI commands for OSPF area types; **Chapter 6** in NRS-II

What you need to submit and when:

1. Complete the “Lab 2 Post-lab” exercise on Blackboard by the assigned due date for your lab section.

Required Equipment:

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

Marks:

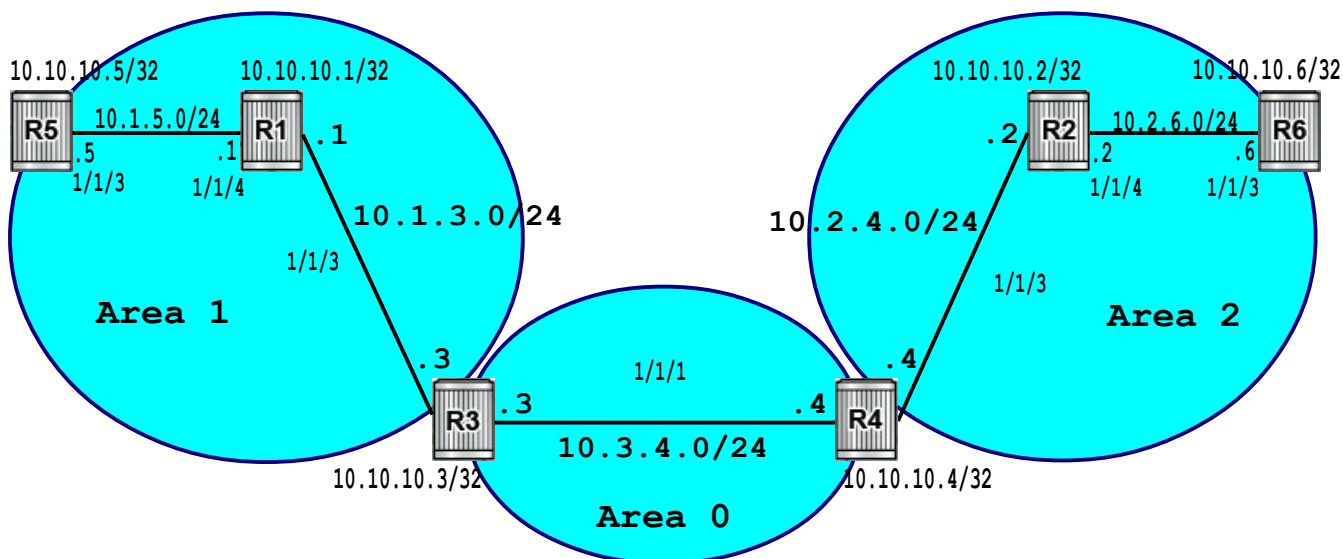
10% of your final mark is for labs done during the course of the semester.

References and Resources:

- Command references provided in previous labs
- Ch 6, NRS-II book: for additional commands for configuring specific OSPF area types
- MySRLab: remote-access lab facility hosted at the Nokia Kanata campus

Topology

This is the MySQLLab network topology that is used for this lab. It is similar to the top half of your Edu topology from the weekly in-lab. **NOTE:** that **not** all links are configured and activated!



Addressing Table for MySQLLab 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
PC	188.10	188.42	188.74	188.106	188.138	188.170

For further experimentation, a PC can be accessed via the Remote Desktop Protocol (RDP), which has clients available for Windows (built-in as "Remote Desktop Connection" or mstsc.exe), Linux (rdesktop), and OSX (<http://cord.sourceforge.net/>)

The PC is connected to port 1/1/4 of R5.

PC #	RDP port	User ID	Password
PC1	3389	plXstudent	plXstudent

Where **X** = the practice Lab number (i.e. 3-8)

Task 1: Configure single area OSPF

Repeat the procedure from Lab 2, configuring OSPF as a single area. Use the topology from the previous page, but **put all routers in area 0**. Since you are doing this in MySRLab, you are responsible for **all 6 routers**. This is the **reference network** so get it correct!!

- Don't forget to include the *system* interfaces.
- Leave all links at their default (don't configure any links as point-to-point)

Note that you may find that you need to wait as long as ~30 secs at the end before the final convergence of OSPF. It's an excellent idea to save output from the commands below, since you will need to compare & contrast to see the effect of the changes you make.

Capture the output of at least these verification commands:

```
show router route-table      # show all the routes; should be 11! (6 system + 5 subnets)
show router ospf neighbor   # the neighbor state should be "Full"
show router ospf database   # show all the LSAs
```

SAVE the configs from **all** routers (see Task 7 for help). **You will need this setup in future!!**

Questions to answer:

- How many LSAs are in the database for the converged network?
- Do all routers have the same number of LSAs?
- What is the exact SR OS name for the type 1 LSA?
- How many type 1 LSAs are there?
- What is the exact SR OS name for the type 2 LSA?
- How many type 2 LSAs are there?

Task 2: Configure a simple multi-area OSPF network

- Step 1. Shutdown and remove area 0 from R1, R2, R5, R6 (this will clear all LSAs):
`configure • router • ospf • shutdown`
`configure • router • ospf • no area 0`
- Step 2. Remove all interfaces currently in area 0 that should be in area 1 or area 2
eg. `configure • router • ospf • area 0 • no interface toR1`
NB: System interfaces for R3-R4 stay in area 0
- Step 3. Create new OSPF areas as indicated on the topology diagram, and add the appropriate interfaces. Don't forget to include the relevant system interfaces.
- Step 4. Ensure that stale LSAs from the single-area configuration are flushed from R3-R4:
eg. `clear • router • ospf • database`
(or `configure • router • ospf • shut` on **all** routers, then after `no shut`)
- Step 5. WAIT! It may take as long as 20-30 sec for OSPF to reconverge!
- Step 6. Confirm that the network is converged: the number of routes should be the same as the single area configuration.
- Step 7. Capture and record the output of at least the three verification commands (above).

Questions to answer:

- What is the total number of LSAs of an ABR for the converged network?
- What is the exact SR OS name for the type 3 LSA?
- How many type 1 LSAs are on either ABR?
- How many type 2 LSAs are on either ABR?
- How many type 3 LSAs are on either ABR?

Task 3: Configure an ASBR

Now you will add an "external" route, in the form of a loopback that isn't natively part of OSPF. It will be advertised by an ASBR, **R5**, in Area 1. You need to put it into OSPF using a *policy* statement, which serves the equivalent purpose of a Cisco ACL. You may want to review your notes from NET3008 to refresh your understanding of OSPF ASBR behaviour.

Step 1. Add the extra loopback on **R5** with address 10.10.10.55/32:

```
interface myLoopback1
  address 10.10.10.55/32
  loopback # alternative to "port x/x/x"
```

Step 2. Define the required policy statement:

```
configure router policy-options
begin
  prefix-list myExternalRoutes
    prefix 10.10.10.55/32 exact
  exit
  policy-statement DemoExternalExport
    entry 10
      from prefix-list myExternalRoutes
      action accept
    exit
  exit
exit
commit
exit
```

Step 3. Designate R5 as an ASBR:

```
configure • router • ospf
asbr
```

Step 4. Apply the policy. **NOTE:** Nokia uses **export** instead of Cisco's **redistribute**

```
configure • router • ospf
  export DemoExternalExport
```

Step 5. Check that the network has converged. (How?)

Step 6. **NOTE:** How many routes and LSAs are on **R2**?

Save this! You'll need it for the next task.

Questions to answer:

- How many routes appear in **R3**'s route table now?
- What is the total number of LSAs on R3 (an ABR) for the converged network?
- What is the total number of LSAs on R4 (other ABR) for the converged network?
- What is the exact SR OS name for the **type 5** LSA? (Exactly as printed)
- What is the exact SR OS name for the **type 4** LSA? (Exactly as printed)
- What area is the type 5 LSA "coming from"? (Exactly as printed)

Task 4: Configure a Stub area

Now you will convert **Area 2** into a Stub area. Observe the behaviour of OSPF carefully between each of the steps in this task! Does it behave the way you would expect? You may want to review your notes from NET3008 to refresh your understanding of OSPF stub areas.

- Step 1. Convert area 2 on **R2** to a Stub area:
`configure router ospf area 2
stub`
- Step 2. Observe what happens to the OSPF neighboring within the area.
- Step 3. Configure all other routers in the area to Stub.
- Step 4. WAIT! It make take as long as 20-30 sec for OSPF to reconverge!
- Step 5. Compare the status of R2 now with the last step from the previous task.

Questions to answer:

- How many routes appear in R2's route table (ie. within the stub area)?
- What is the total number of LSAs on R2 ?
- What route in the routing table allows R2 to reach all destinations in Area 0 & 1?
- How many type 1 LSAs are on R2?
- How many type 2 LSAs are on R2?
- How many type 3 LSAs are on R2?
- How many type 4 LSAs are on R2?
- How many type 5 LSAs are on R2?

Task 5: Configure a Totally Stubby area

Now you will convert **Area 2** into a Totally Stubby area. Observe the behaviour of OSPF carefully between each of the steps in this task! Does it behave the way you would expect? You may want to review your notes from NET3008 to refresh your understanding of OSPF Totally Stub.

- Step 1. Convert area 2 on **R2** to a Totally Stubby area:
`configure router ospf area 2
stub no summaries`
- Step 2. Observe what happens to the OSPF neighboring within the area.
- Step 3. Configure all other routers in the area to Totally Stubby.
- Step 4. WAIT! It make take as long as 20-30 sec for OSPF to reconverge!
- Step 5. Compare the status of R2 now with the last step from the previous task.

Questions to answer:

- How many routes appear in **R2**'s route table (within the Totally Stub area)?
- What is the total number of LSAs on R2 ?
- What route in the routing table allows R2 to reach all destinations in Area 0 & 1?
- How many type 1 LSAs are on R2?
- How many type 2 LSAs are on R2?
- How many type 3 LSAs are on R2?
- How many type 4 LSAs are on R2?
- How many type 5 LSAs are on R2?

Task 6: Configure a Not So Stubby Area (NSSA)

Now you will convert **Area 1** into a Not So Stubby Area. Observe the behaviour of OSPF carefully between each of the steps in this task! Does it behave the way you would expect? You may want to review your notes from NET3008 to refresh your understanding of OSPF NSSA.

- Step 1. Check the OSPF database on **R1**. You'll need to compare before-and-after.
- Step 2. Convert area 1 on **R1** to NSSA:

```
configure router ospf area 1
nssa
```
- Step 3. Observe what happens to the OSPF neighboring within the area.
- Step 4. Configure all other routers in the area to NSSA.
- Step 5. WAIT! It make take as long as 20-30 sec for OSPF to reconverge!
- Step 6. Compare the status of **R1** now with the first step. What has changed?
- Step 7. Have a look on routers in other areas (eg. R4, R2) and compare with R1. What differences, if any, are there in the routing table? The OSPF database?

Questions to answer:

- How many routes appear in **R1**'s route table (within the NSSA)?
- What is the total number of LSAs on R1 ?
- What is the exact SR OS name for the **type 7** LSA?
- How many type 1 LSAs are on R1?
- How many type 2 LSAs are on R1?
- How many type 3 LSAs are on R1?
- How many type 4 LSAs are on R1?
- How many type 5 LSAs are on R1?
- How many type 7 LSAs are on R1?

Task 7: Save all your configs

You'll want to **save your final configs** so that you can refer to them later for additional practice and study purposes. Here's a few SR OS commands, so that you see the keywords and format for saving & managing configuration files.

save: admin save ftp://{mySRLabAlphaLogin}:{assignedPswd}@mysrlab/STD/**Rx**/L2.cfg
verify: file dir ftp://{mySRLabAlphaLogin}:{assignedPswd}@mysrlab/STD/**Rx**/