

Test 1: NET3012 – IP Architectures & Solutions

Winter 2014

Time: 50 minutes; Test scored out of: 40 Total Marks available: 46
(Allocation of marks is shown beside each question)

Instructions:

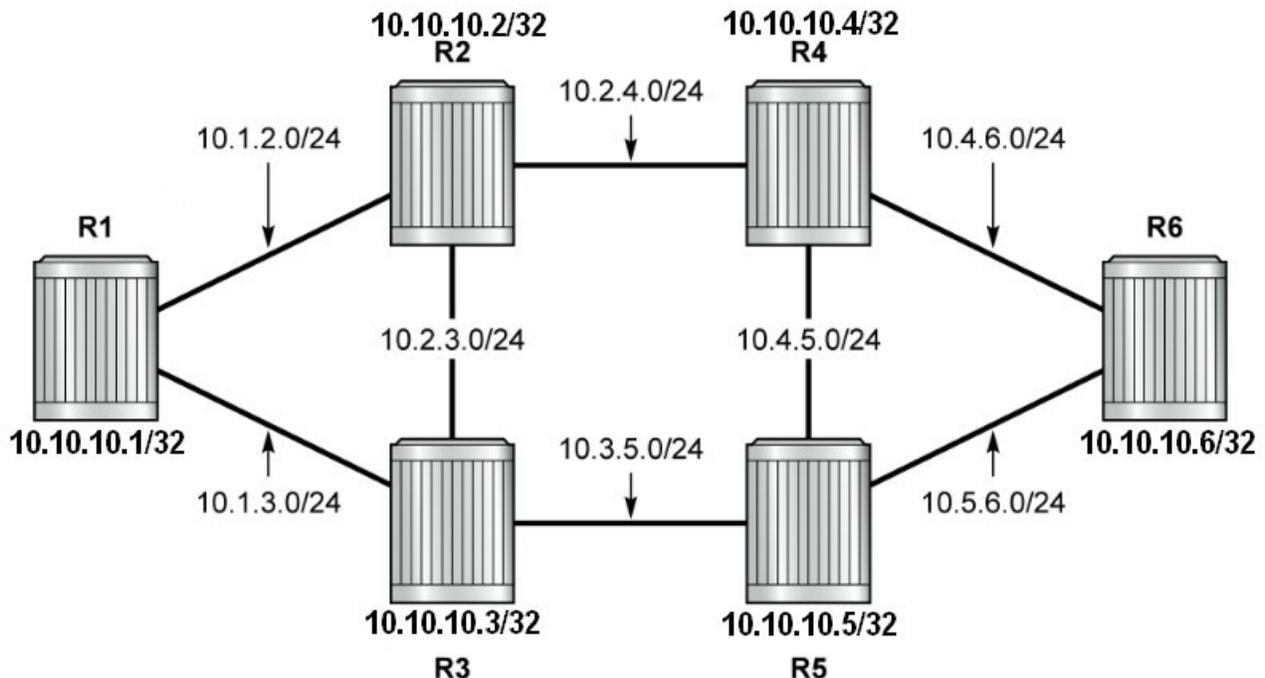
1. **BEFORE** answering any questions, please check that your copy of the test has all pages (as indicated in the footer at the bottom of each page). Please **read all questions** carefully, then answer question 0 first!
2. This is a **closed book** test. No textbooks, notes, electronic devices, or any other aids are permitted.
3. The lab guide we've been using is dated Nov 24, 2011.
4. If you are uncertain what a question is asking, make reasonable assumptions, write those assumptions down on this test paper, and continue answering the question.

0. What is your:

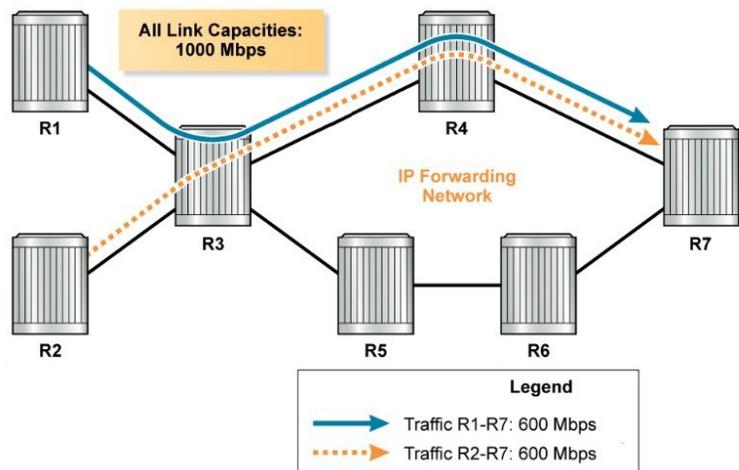
NAME? _____

Reference Topology

Use the topology below for questions which refer to R1-R6 but do **not** have a topology diagram. Note that this is the standard topology we have been using throughout the course.



1. A. [2 marks] **Clearly** explain the term "hyper-aggregation". Specific details from the diagram on the right (eg. addresses, links, and/or hosts) **must** be included in your explanation.



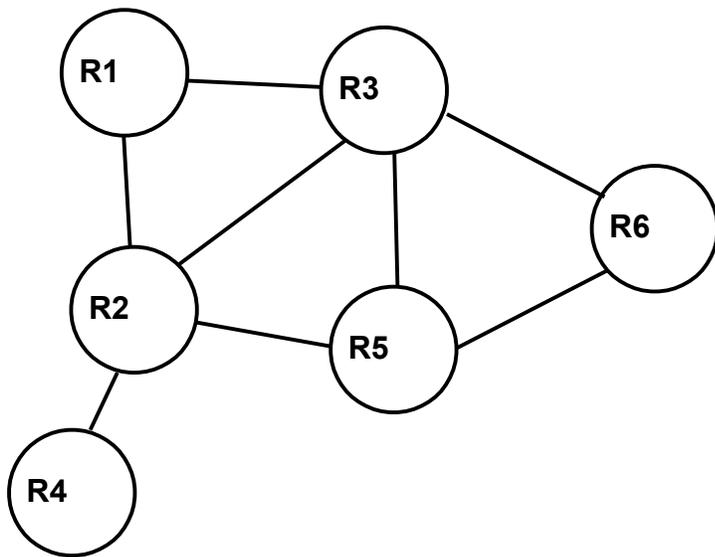
- B. [2 marks] **Clearly** explain: **What** role can Traffic-Engineering play in the above scenario? **Why** (or how) is it able to accomplish what it does?

2. [3 marks] Name and briefly describe the 3 different VPN services made possible by MPLS.

3. [3 marks] **Clearly** define the three MPLS label operations. [Ref: slide 1-40, Q4]

4. [2 marks] **Clearly** define the terms LFIB and LIB. Include their relevance to the appropriate router plane. (Reminder: there are two planes in a router.)

5. Carefully examine the network topology below. There are six routers; the label tables for the first five routers are given on the right.



A. [4 marks] Complete the last column in the table below, showing which router originates each FEC.

R6 Label Table

FEC	OUT Label	Next Hop	Originator?
X	100	R5	
Y	200	R3	
Z	300	R5	
Q	400	R3	

B. [2 marks] Pick one of the FECs from R6's table. **Circle** it. Identify all **eLER**, **iLER**, and **LSR** routers relevant to that FEC by writing those terms on the topology diagram above.

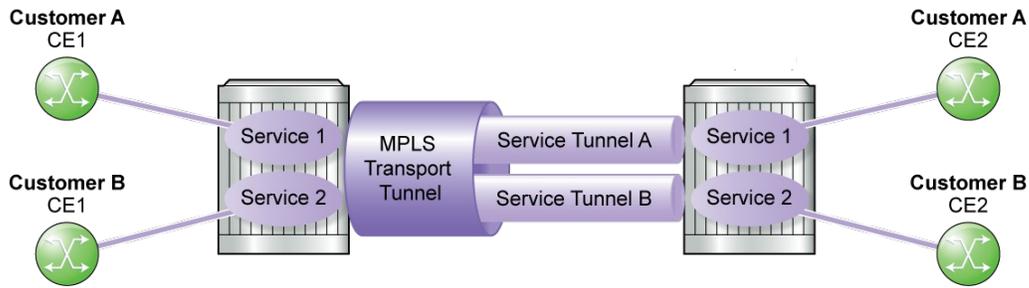
IN label	OUT label	Next Hop
R1		
240	130	R2
110	pop	IP
330	pop	IP
140	160	R2
150	170	R2
R2		
170	pop	IP
210	330	R1
130	150	R4
160	260	R5
R3		
100	110	R1
140	130	R2
220	330	R1
120	210	R2
400	140	R1
130	260	R5
350	150	R1
200	240	R1
R4		
150	pop	IP
R5		
160	130	R2
100	120	R3
300	350	R3
260	pop	IP

6. [4 marks] Pictured below is an MPLS header in an ethernet frame. In the available space, write the name of each of the four fields, then briefly (but **clearly**) describe each one below.



7. [1 mark] A customer packet passes through 10 LSR routers in the service provider's MPLS VPN network. What happens to the TTL in the customer packet at each of those 10 hops? Assume the service provider's equipment is running in pipe mode. [Ref: slides 2-17,18]
8. [2 marks] Give the three label handling characteristics of LDP.
Give the three label handling characteristics of RSVP. [Ref: slide 2-38]
9. [1 mark] MPLS routers depend on (and **require**) what (kind of) protocol to distribute the **reachability** information that the routers use to generate LFIB entries? [Ref: slide 2-57, Q9]
10. **A.** [1 mark] Which label distribution method requires that the iLER request and wait to receive a label from the next-hop before forwarding data downstream? (But see part B!)
- B.** [1 mark] Which protocol **uses** the above method?

11. Carefully examine the diagram below: it shows two customers of a service provider who need full connectivity between their branch offices on opposite sides of the country [Ref 3-6]



A. [1 mark] Link LDP is used for one type of tunnel; T-LDP is used for the other type. **Clearly** identify which type of LDP is used for each type of tunnel.

B. [2 marks] Think carefully: in the above scenario, what is the total number of LSPs required to implement full connectivity for both clients? **Explain** your answer!

12. A. [1 mark] **Identify** which Layer 4 transport protocol is used to establish LDP adjacencies, and to establish LDP sessions.

B. [1 mark] **Identify** any changes between link and targeted LDP.

13. The figure below shows the output from "show router ldp bindings" from router R1 in the reference topology (shown on the cover page). Examine it carefully and then answer the questions below about the rows that have been highlighted with bold font.

```
A:R1# show router ldp bindings
Legend: U - Label In Use, N - Label Not In Use, W - Label Withdrawn
```

Prefix	Peer	IngLbl	EgrLbl	EgrIntf/	EgrNextHop
10.10.10.1/32	10.10.10.2	131070U	--	--	--
10.10.10.1/32	10.10.10.3	131070U	--	--	--
10.10.10.2/32	10.10.10.2	--	131071	1/1/4	10.1.2.2
10.10.10.2/32	10.10.10.3	131071U	131066	--	--
10.10.10.3/32	10.10.10.2	131069U	131066	--	--
10.10.10.3/32	10.10.10.3	--	131071	1/1/3	10.1.3.3
10.10.10.4/32	10.10.10.2	131068N	131070	1/1/4	10.1.2.2
10.10.10.4/32	10.10.10.3	131068U	131069	--	--
10.10.10.5/32	10.10.10.2	131067U	131069	--	--
10.10.10.5/32	10.10.10.3	131067N	131068	1/1/3	10.1.3.3
10.10.10.6/32	10.10.10.2	131066N	131068	1/1/4	10.1.2.2
10.10.10.6/32	10.10.10.3	131066U	131067	--	--

- A. [1 mark] **Clearly** explain why there are no egress details for the first two rows (in bold).
- B. [2 marks] For the first two rows (in bold), the ingress label is identical. Will that always be the case? **Clearly** explain why or why not.
- C. [2 marks] For the last two rows in bold, the egress label is identical. Will that always be the case? **Clearly** explain why or why not.
- D. [1 mark] For the middle row that's bolded, the ingress label is marked with "N". **Clearly** explain the significance and reason for that marking.

14. [2 marks] **Clearly** explain the use of a PSB and RSB in the creation of an RSVP LSP.

15. [1 mark] By default, how does RSVP ensure that sessions don't time out?

16. Some students are experimenting with RSVP. They ensure that both MPLS and RSVP are enabled and running on suitable interfaces, and then type exactly the lines below:

```
path "empty_list"  
exit  
lsp "to_R6"  
  to 10.10.10.6  
  primary "empty_list"  
  exit  
exit
```

A. [1 mark] What command could be used to test whether the LSP is fully operational?

B. [2 marks] Unfortunately the LSP isn't working! What's missing? (Either explain, or better yet, fix it!)

17. [1 mark; Bonus] What's the date on the front cover of the MPLS lab guide?

Extra Work