

Test 2: NET3012 – IP Architectures & Solutions

Winter 2015

Time: 50 minutes; Test scored out of: 43 Total Marks available: 46
(Allocation of marks is shown beside each question)

Instructions:

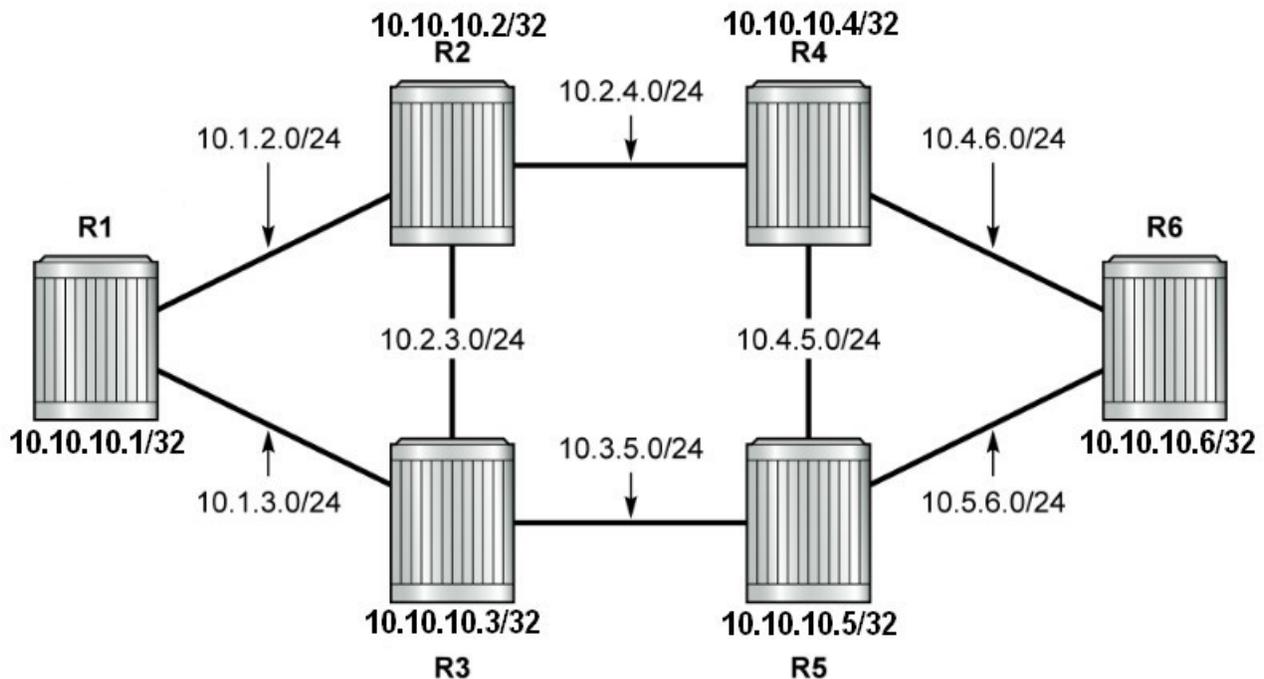
1. **BEFORE** answering any questions, please check that your copy of the test has all pages (as indicated in the footer at the bottom of each page). Please **read all questions** carefully, then answer question 0 first!
2. This is a **closed book** test. No textbooks, notes, electronic devices, or any other aids are permitted.
3. 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. [1 mark] Which of the following protocol(s) **cannot** be transported in MPLS?
(i) IP (ii) Ethernet (iii) ATM (iv) Frame Relay

2. [1 mark] According to the Alcatel-Lucent course material, **clearly** identify what is the primary purpose of using MPLS for IGP shortcuts?

3. [1 mark] Which statement(s) is/are **correct** regarding the definition of a P router?
(A) P routers are service-aware.
(B) P routers are typically LERs.
(C) P routers perform label PUSH and POP operations.
(D) P routers have all their interfaces inside the service provider domain.
(E) None of the above.

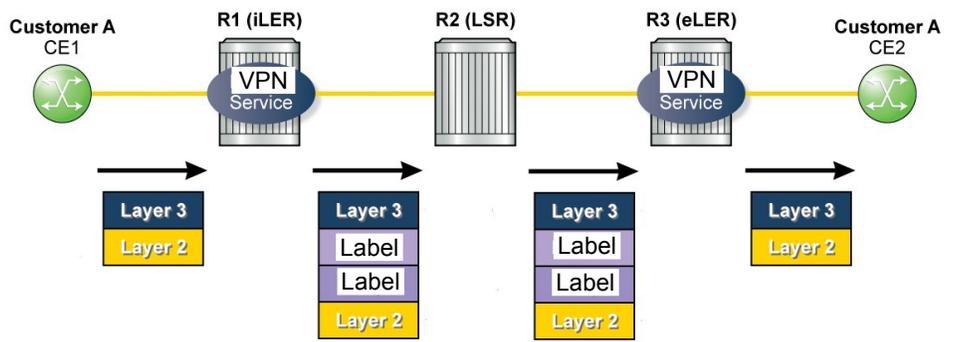
4. [2 marks] For the first two answers in the previous question that are **not** correct (whichever ones those are), **clearly** explain why they are not correct.

5. [1 mark] Which factor is a primary cause of IP hyper-aggregation? **Circle** your answer. *
(A) IP routing protocols do not always select the best route to a destination
(B) IP routing protocols always select multiple routes to a destination
(C) IP routing protocols do not make use of all available network attributes to select a path
(D) Improper network design results in limited network path redundancy
(E) My lab partner does not configure the network correctly during lab period.

6. [1 mark] Which of the following statements are true regarding the roles of devices in an MPLS domain? **Circle 2** answers. *
(A) An LSR is located internal to the provider domain and switches labeled packets
(A) An LER is located internal to the provider domain and switches labeled packets
(C) An LSR is located at the boundary of the provider domain and may forward labeled or unlabeled packets
(D) An LER is located at the boundary of the provider domain and may forward labeled or unlabeled packets
(E) An LER is located external to the provider domain and switches unlabeled packets

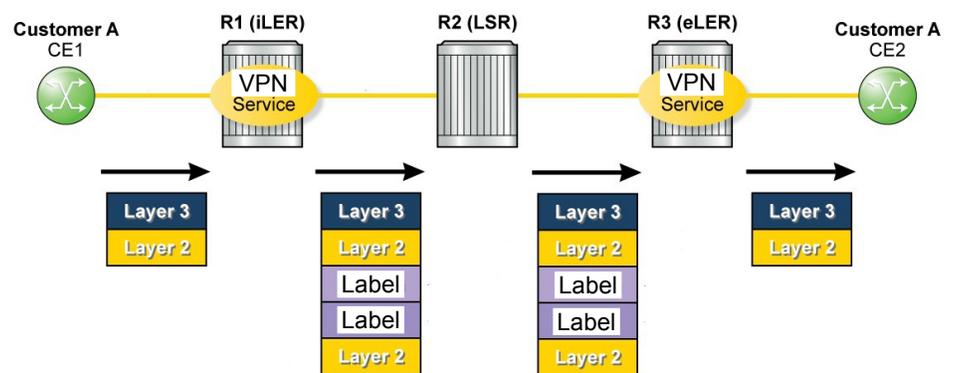
7. [1 mark] Which of the following statements are true? **Circle all that apply.** *
- (A) Selected labels from the FIB are populated to the LIB
 - (B) Selected labels from the LIB are populated to the LFIB
 - (C) Selected routes from the RIB are populated to the FIB
 - (D) Selected routes from the FIB are populated to the RIB
 - (E) All labels from the LIB are populated to the LFIB
8. A. [1 mark] **Clearly** identify the specific options for the three characteristics for label handling in MPLS. (ie. control mode, distribution mode, retention mode)
- B. [1 mark] **Clearly** identify which of the above options are used by RSVP.
9. [2 marks] **Correctly** name and **clearly** identify at least 4 types of VPWS services.
10. [2 marks] **Clearly** identify which protocols are used to signal service labels for VPN services. Be very specific about what VPN service each protocol serves.
11. A. [1 mark] Within the full MPLS label space, there are several ranges of labels. **Clearly** identify the first range, (including its name). Give an indication of the approximate size of this range.
- B. [1 mark] **Clearly identify** a specific label value, and give its value/number, that was seen in conjunction with MP-BGP in the 6PE post-lab.

12. A. [2 marks] Study the diagram carefully. What kind(s) of VPN service is/are illustrated? Justify your answer!!



B. [1 mark] **Clearly** mark on the diagram which Ethernet headers are identical, or write "none" below if they are all unique.

13. A. [2 marks] Study the diagram carefully. What kind(s) of VPN service is/are illustrated? Justify your answer!!



B. [1 mark] **Clearly** mark on the diagram which Label(s) are identical, or write "none" (in the space below) if they are all unique.

C. [1 mark] **Clearly** mark on the diagram which Label(s) have the "S" bit set, or write "none" (in the space below) if none have it set.

14. [1 mark] What is the relationship between ports and SAPs: ie how many ports can be configured per SAP, or alternatively, how many SAPs can be configured per port?

15. [3 marks] For a moment, forget about VPN services. MPLS can improve conventional network operation in multiple different ways. Name and **clearly** identify at least three uses for MPLS that do not require (or use) service labels. Hint: think lab work (in-lab, post-lab).
16. [1 mark] Based on the reference topology on the front page, identify **all** possible RSVP-TE paths from R1 to R6 for a `hop-limit` count of **3**. Hint: What's important to remember about `hop-limit` count?
17. A. [1 mark+1 bonus] Write a fully-strict MPLS path from R1 to R6 in the reference topology.
- B. [1 mark] Write a fully-loose MPLS path from R1 to R6 in the reference topology.
- C. [1 mark] Write a MPLS path definition from R1 to R6 with a mix of strict and loose hops.
- D. [1 mark] Each of the three definitions above need one identical statement to become fully operational. What is that statement?

18. [1 mark] We know that the IGP metric represents interface speed. For TE metric, give an example with a brief but **clear** explanation of what it might be used to represent.
19. A. [2 marks] In the context of MPLS, what is an "ERO"? Give specific details about protocol(s) and message type(s).
- B. [1 mark] What are the two sources (or mechanisms) that "build" an ERO?
20. [3 marks] Identify and give a brief but **clear** explain of three optimizations to the base RSVP protocol.
21. [2 marks] Correctly group the terms: PATH, PATH-Error, PATH-Tear, RESV, RESV-Error, and RESV-Tear, according to whether they flow upstream or downstream.

22. [2 marks] Consider a scenario of a service provider installation in Vancouver:

- All the traffic for many different services, for many different customers, needs to go to Toronto via one ePipe, except for the provider's management traffic which must be sent directly to headquarters in Ottawa via a different ePipe.
- There is only a single physical connection at the Vancouver site.

Clearly identify how you can achieve these goals, give specific details relating to an example configuration.

B. [2 marks] Identify the MTU requirements for each of the ePipes above; with a brief (eg. 1-line) explanation to justify the value.

Extra Work