# Test 1: NET3012 – IP Architectures & Solutions

Winter 2015

Time: 60 minutes; Test scored out of: 42 Total Marks available: 45
(Allocation of marks is shown beside each question)

**Instructions**:

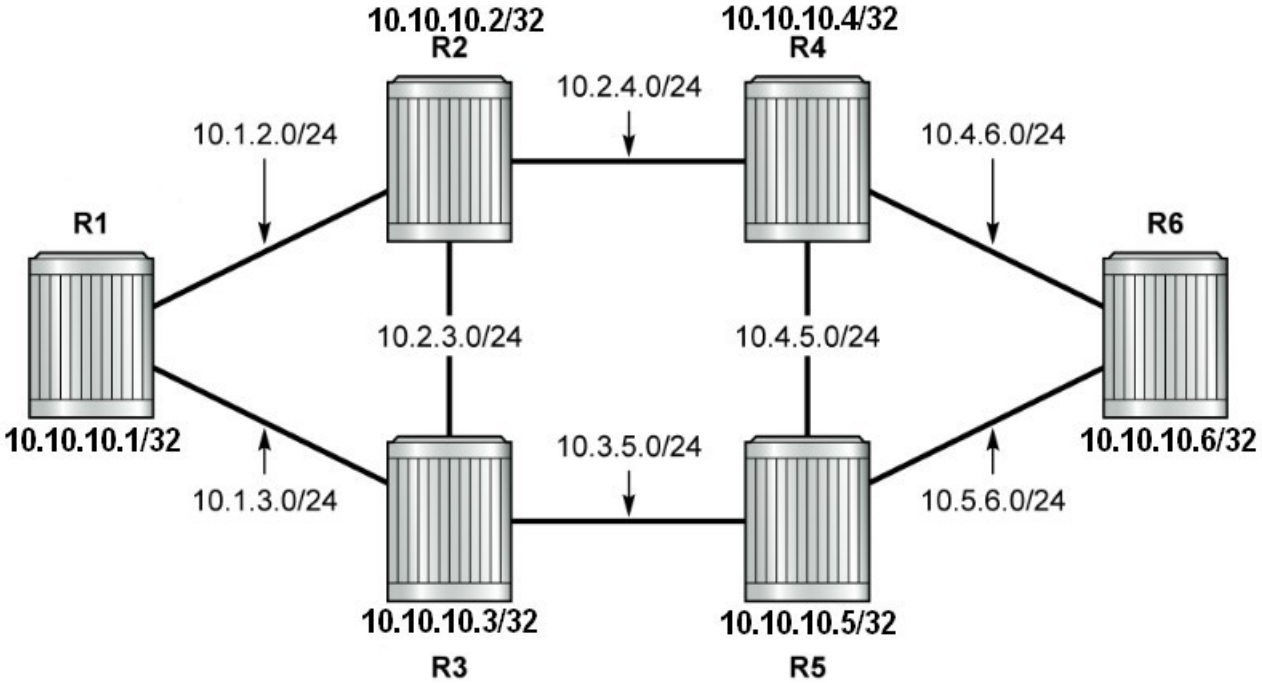
1. BEFORE answering any questions, please check that your copy of the test has all pages (as indicated in the footer at the bottom of each page). Please **read all questions** carefully, then answer question 0 first!
2. This is a **closed book** test. No textbooks, notes, electronic devices, or any other aids are permitted.
3. All references to "NRS-II" mean the "Network Routing Specialist II Self Study Guide", ISBN: 978-0-470-94772-2
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 used throughout the MPLS courseware and slide decks.



1. A textbook says: *VLL [or "Layer 1"] VPNs offers two advantages: a way of creating a simple, direct link for a customer between two sites that are physically very far apart; and the ability to converge provider networks by transporting legacy networking technologies*.

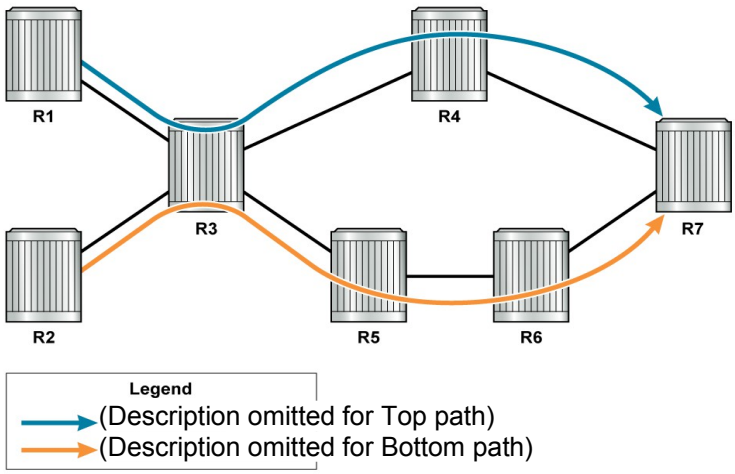
   A student says: "I understand the first advantage, but not the second." Help the student by:

   [1 mark] Naming at least two of the "legacy networking technologies"

   [1 mark] **Clearly** explaining what the word "converged" means in this particular context.

2. [2 marks] Name and briefly describe two (2) multi-point VPN services.

3. [2 marks] The diagram illustrates an advantage of using an MPLS network. Unfortunately the Professor wiped out the labels describing the two paths. (A) **Clearly** identify and/or describe the two types of paths, and (B) the advantage of MPLS that is illustrated. (Assume all links are equal cost.)



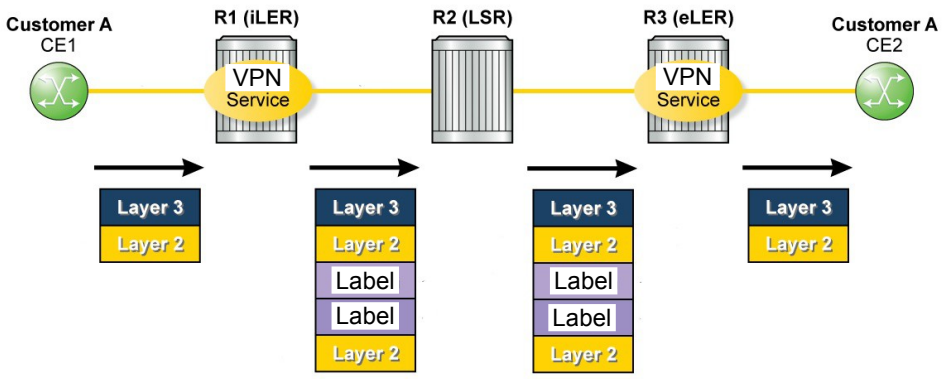
4. [2 marks] Clearly define an MPLS Forwarding Equivalence Class (FEC). [Ref: Mod 1 p. 40]

5. [2 marks] Put these terms into related groups: bottom, inner, outer, service, top, transport as they relate to MPLS labels. (Maybe make a sentence?) Use as few groups as possible.

6. [2 marks] An MPLS router receives some sort of frame on an Ethernet interface. Explain **clearly** how the router determines exactly what that frame is / contains (ie. a conventional IP routed packet or MPLS switched packet?) Be as specific as possible! Hint: material from NET3011 may be relevant and helpful in your explanation.

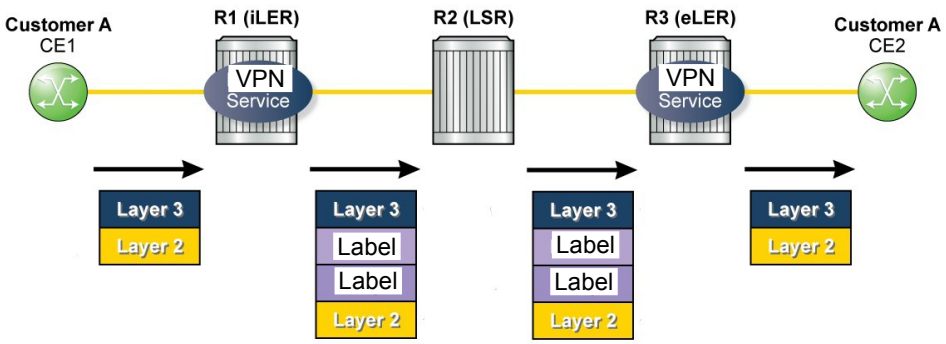
7. [1 mark] How many services tunnels can a single MPLS transport tunnel carry? [Mod 2-6]

8. 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.

9. 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 Labels are identical, or write "none" (in the space below) if they are all unique.

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

10. [1 mark] "Pipe mode" and "uniform mode" relate to the handling of two different fields (or values) in a customer's packet. Which two fields are they?

11. [2 marks] **Clearly** explain the difference between "pipe mode" and "uniform mode" for MPLS tunnels. Indicate which one Alcatel-Lucent equipment implements. Note: you may draw numbers on either of the diagrams above to help explain or illustrate your explanation.

12. [3 marks] **Clearly** identify at least three (3) different ranges in the MPLS label space (… other than the "Reserved for future use" ranges!). [Ref: slide 2-11]
[1 Bonus] Include the correct numeric range for at least two of the ranges.

13. [2 marks] Give a **clear**, brief description of PHP in the context of MPLS. (Note: please do *not* confuse MPLS PHP with the PHP used for web page scripting!) What labels are used?

14. [1 mark] In general terms, what kind of router requests PHP?

15. [1 mark] In MPLS, which control mode ensures a loop-free LSP path? [Ref: Mod 2, Q9]

16. [1 mark] What special use label tells the next-hop router to process the received packet in the control plane? [Ref: Mod 2, Q16]

17. [1 mark] What label distribution method requires that the iLER request and and wait to receive a label from the next-hop before forwarding data downstream?

18. [2 marks] **Clearly** explain the difference between an "LDP adjacency" and an "LDP session". You must reference the transport protocol used in each case. [Ref: Mod 3-20]

19. [2 marks] Put the terms in related groups: control plane, data, data plane, downstream, labels, and upstream as they relate to MPLS labels. Use as few groups as possible.

20. [1 mark] **Clearly** identify what kind of connectivity is obtained once LDP converges.

21. A. [1 mark] Give a complete, correct usage of the command to test LSP operation.

    B. [1 mark] **Clearly** identify a difference in usage when using the above command with LDP and RSVP LSPs. (eg. Give different forms of the command.)

    LDP: _____

    RSVP: _____

22. [2 marks] When testing an LSP, the test request travels via the LSP and the response returns via the IGP. **Clearly** explain why logically this ***must*** be the case for how it works.

23. [2 mark] What single protocol can be used to exchange labels for *both* transport and service tunnels? Give specific names of variations of the protocol. [Ref: Mod 2, 3]

24. [1 mark; Bonus] What the ISBN number of the NRS-II ebook used as the course textbook?

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## Extra Work