TELE3118 Tutorial 4: Network Layer: Routing

1. Distance Vector Routing

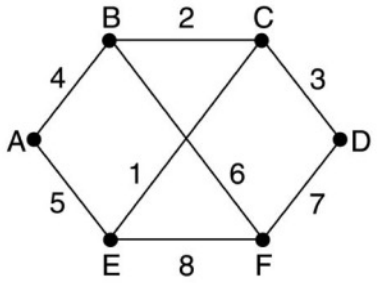
In a network with six nodes A-F, distance vector routing is used, and the following vectors have just come in to router C:

from B: (5, 0, 8, 12, 6, 2);
from D: (16, 12, 6, 0, 9, 10);
from E: (7, 6, 3, 9, 0, 4).

The cost of the links from C to B, D, and E, are 6, 3, and 5, respectively[1]. What is C's new routing table? [Assume it was empty before these vectors.] Give both the outgoing line to use and the cost.

2. Link State Routing

For the figure below, show how Dijkstra's algorithm can be used to find the shortest path from node B to each other node in the network. If you have a choice of equally-suitable next working nodes, then choose the one that occurs earliest in the alphabet.



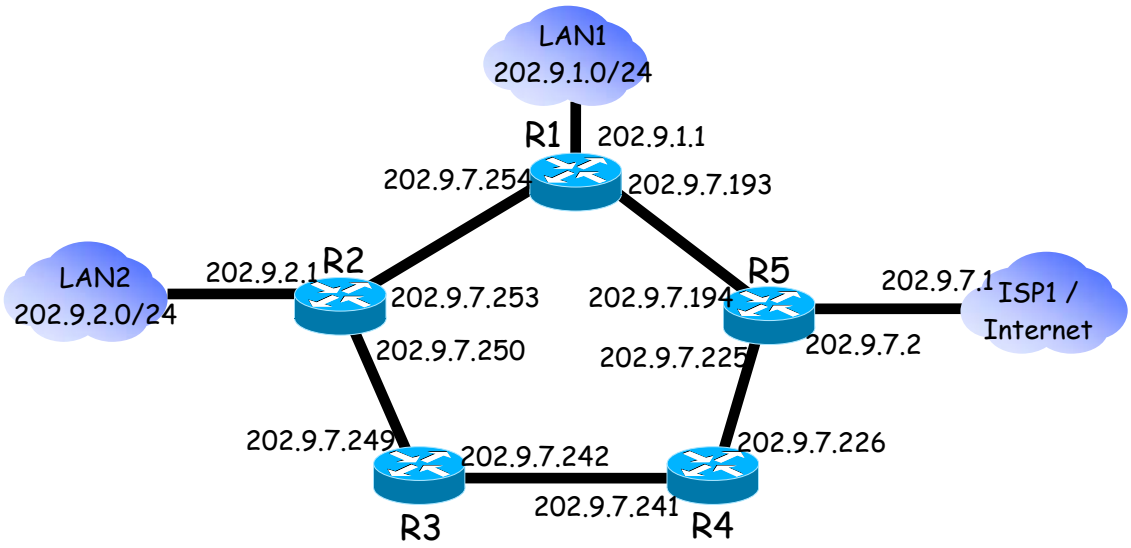
(a)

	A		C		D		E		F	
Working node	cost	via	cost	via	Cost	via	cost	via	cost	via
Result:										

[1] These quantities may differ from the quantities advertised by neighbours because links may be asymmetrical, or the advertisements by neighbours may be based on older information. e.g. B says the cost to reach C is 8 whereas C says the cost/delay to reach B is 6.

3. Hierarchical Routing

Your corporate Ethernet/IP network has topology shown below. The router interface IP addresses and the LAN network prefixes are indicated in the figure. Internet connectivity is via ISP1 connected to router R5. Assume that ISP1 owns address block 202.9.0.0/16, of which your organization has obtained sub-block 202.9.0.0/21. Answer the following questions in sequence. Note that assumptions in one part carry over to subsequent parts unless stated otherwise.



a) Assume that all links have identical cost of 1. Would you pick RIP or OSPF as the interior gateway protocol (IGP) for the network? Justify your answer.

b) Assuming the network runs OSPF, router R5 learns routes that allow it to forward packets coming from the Internet to LAN1 and LAN2 via the shortest path. List the two routes (one corresponding to each LAN) at R5 as 3-tuples of the form <*destination*, *mask*, *next-hop*> in dotted-IP notation.

c) Shortest-path routing from R5 to LAN1 and LAN2 leads to the lower path being unutilized. To load-share traffic on both paths, you decide to configure a static route at R5 that sends part of the traffic on the lower path (note that the static route is in addition to dynamic routes computed by OSPF). Show a static route (1 in number) at R5 that achieves load-sharing.

d) Now suppose the R3 – R4 link breaks. Demonstrate that your static route of the previous part, combined with dynamic routes from OSPF, will make some destinations in LAN1/2 unreachable.

e) Now consider packets from LAN1/2 meant for the Internet. Explain the minimal configuration required in your network so packets meant for the Internet will be routed (via shortest path) to ISP1.

f) Now suppose your organization gets a second Internet connection via ISP2 connected to router R3. Suggest a simple way by which you can load-share the outbound traffic on the two ISP links.

g) To achieve load-sharing on the two ISP links for inbound traffic (namely, traffic from the Internet to LAN1/2), you decide to run a BGP-session with ISP2 and advertise the organization's prefix 202.9.0.0/21 to ISP2. If you do so, what will be the consequence for inbound Internet traffic?

h) Suggest a way by which inbound traffic can be load-shared on the two ISP links. Your solution should require no changes in the ISP domains.