

We'll post an outline of each recitation after the fact so you know what was covered in case you had to miss class that day. The recitation outlines are not a full replacement for recitation!

This week's recitation was largely a problem-solving session (good for exam prep). These are the problems we went over; some sections may not have gotten to every problem.

BGP + RON

Consider the relationships between seven ASes:

- AS0 is a customer of AS1 and also a customer of AS6
- AS1 is a provider of AS0 and peers with AS2
- AS2 peers with AS1 and AS3
- AS3 peers with AS2 and is a customer of AS4
- AS4 is a provider of AS3 and a customer of AS5
- AS5 is a provider of AS4 and a peer of AS6
- AS6 is a provider of AS0 and a peer of AS5

Question 1: Draw the resulting AS graph

Question 2: Under BGP, which path(s) to AS2 will AS0 learn about?

Question 3: Under BGP, which path(s) to AS3 will AS0 learn about?

Question 4: Suppose the link between AS0 and AS6 fails such that AS6 can no longer provide transit for AS0. Ophelia is concerned that this failure may prevent AS0 from reaching AS6, and starts deploying a RON to help. She starts by deploying one RON node in AS0 and one in AS6

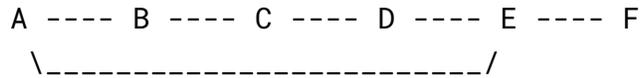
For each scenario below, decide whether a machine in AS0 would be able to send traffic to a machine in AS6.

- Ophelia deploys two additional RON nodes: one in AS2 and one in AS3
- Ophelia deploys two additional RON nodes: one in AS2 and one in AS4
- Ophelia deploys three additional RON nodes: one in AS2, one in AS3, one in AS4.

Question 5: We know that on the Internet, this scenario doesn't really happen; Tier-1 ISPs exist and make sure the entire Internet is reachable. So what is the point of deploying RON on the Internet if not to provide connectivity?

Distance Vector Routing

Consider the following network, which is running a distance-vector protocol. Every link in the network has cost 1, except the link A — E, which has cost 100.



At time 0, assume that every node in the network knows its neighbors, and its link costs to those neighbors, but nothing else. Nodes send advertisements synchronously every ten seconds at times 10, 20, 30, etc. Assume that the latency on each link is virtually zero and that advertisements are integrated within one second. This means that if a node sends an advertisement at time 10, every node that is meant to receive it will have the advertisement, and have integrated it, by time 11. Assume that no advertisements are lost.

Question 1: By what time (in seconds) will A know **some** route to F?

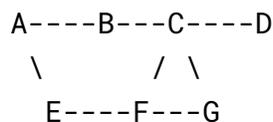
Question 2: By what time (in seconds) will A know the **min-cost** route to F?

Question 3: By what time (in seconds) will C know **some** route to F?

Question 4: By what time (in seconds) will C know the **min-cost** route to F?

Link State Routing

Consider the network below:



Every link in the graph has cost one **except** the link between A and B, which has cost eight.

Alice implements a link-state routing algorithm on this network, using Dijkstra's algorithm and the shown link costs.

Question 1: Using Alice's routing, how will a packet go from A to D? If packets cannot go from A to D, write "no route".

Question 2: Using Alice's routing, how will a packet go from G to A? If packets cannot go from A to D, write "no route".

Question 3: Bob now implements a link-state routing algorithm on this same network, also using Dijkstra's algorithm but using hop counts instead of the link costs in the diagram (a hop count means that each link has a cost of 1 — every "hop" of the network increments the count).

Using Bob's routing, how will a packet go from A to D? If packets cannot go from A to D, write "no route".

Question 4: In a (possibly unwise) compromise, the network operator has chosen to run Alice's routing implementation on nodes A, B, E, and F and Bob's routing implementation on nodes C, D, and G. The two implementations send and receive identical-format advertisements containing all necessary information, but they continue to use different information to make their local routing decisions.

What will happen? Will packets still be able to travel from every source to every destination?