CS 168
Fall 2024

Introduction to the Internet: Architecture and Protocols
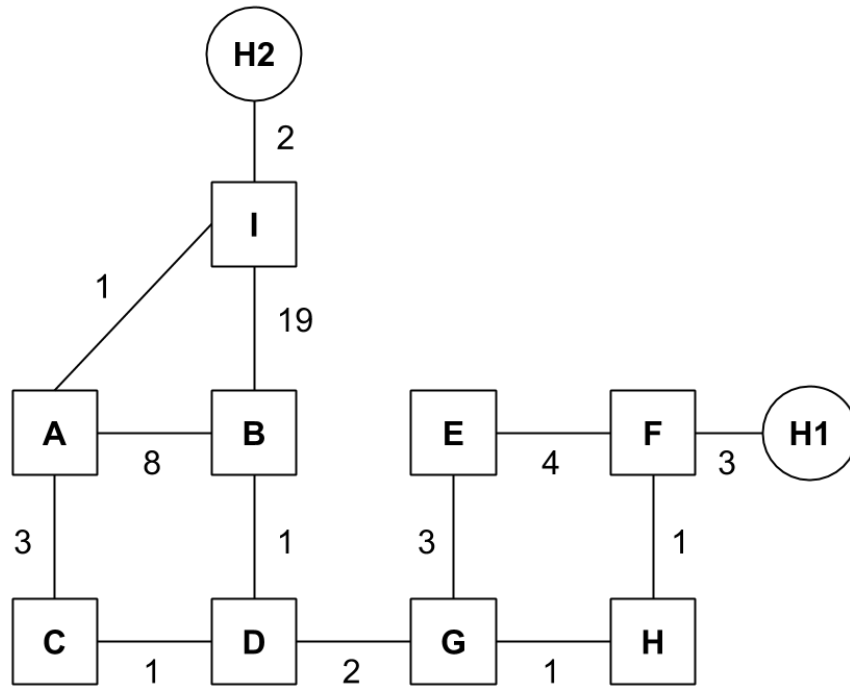Sylvia Ratnasamy, Rob Shakir, Peyrin Kao   Discussion 5: Routing II

1 Link-State Routing

For this problem, assume the network is running a link state routing protocol, minimizing total route latency. The following questions indicate events that happen consecutively.

1. After convergence, what route does **Router D** think its packet will take to **Host H1**?

   EVENT: *Link **GH** goes down.*

2. **Router G** and **Router H** have recomputed their routes, but have not yet sent updates to other routers. What route does **Router D** think its packet will take to **Host H1**?

3. What route does it actually take?

4. Assume all nodes are now aware of the new network state and have recomputed their routes. What route does a packet take from **Router B** to **Host H2**?

EVENT: *The cost of link **AI** increases to 100.*

5. **Router A** and **Router I** recompute their routes, but have not yet sent updates to other routers. What route does **Router A** think its packet will take to **Host H2**?

6. What route does it actually take?

7. Which additional routers must receive the routing updates and recompute their routes for all routers to be able to successfully send packets to **Host H2**?

8. All routers except **Router B** have received the routing updates and recomputed their routes. Which routers can successfully send packets to **Host H2**?

2   L3 Link State Routing Extra Problem
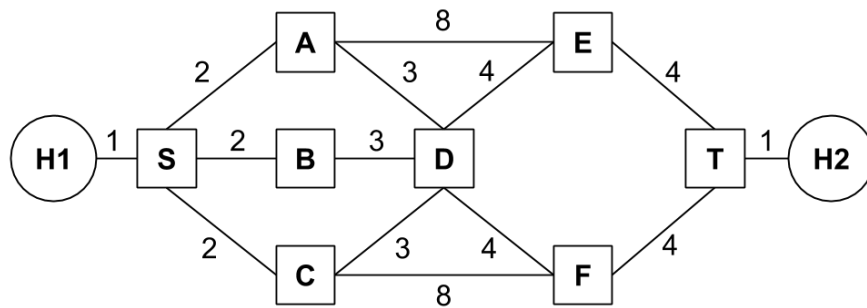
Suppose we have an L3 network with the topology shown above, and the routing algorithm used is link state.

1. After convergence, what is the path cost from H1 to H2, and what are all the possible paths with this cost?

2. Suppose that a control message (a message used by the routing algorithm) takes 1 second to propagate along a link, regardless of link cost. What individual link failure inside the network would cause the longest delay to reconvergence, and what is that delay?

3. Suppose you have the ability to take down individual nodes. Which nodes would you take down in order to partition the network? If you can't partition the network, which nodes would you take down to increase path costs from H1 to H2 maximally? In each part, suppose you can take down:

   (a) a single node (excluding S and T).
   (b) two nodes (excluding S and T).

4. Which single link's cost (if any) should you double in order to increase the path cost from H1 to H2?

3 IP Addressing

Suppose **berkeley.edu** is the Provider AS for EECS, CS, Math, and Chemistry, and needs to assign IPv4 addresses to them.

Assume that the CIDR (Classless InterDomain Routing) addressing scheme is used, and that **berkeley.edu** has the 123.100.0.0/16 prefix reserved.
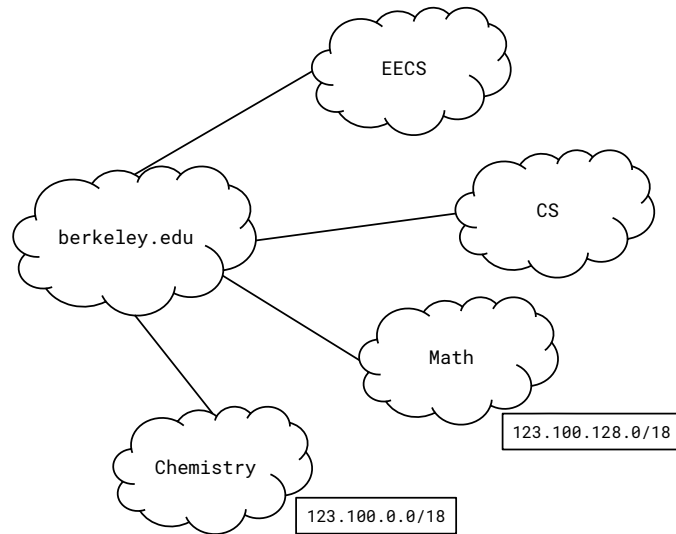
(1) Which addresses are included in the Math department's prefix? How many addresses are in this range?

(2) `123.100.192.0/18` is reserved for EECS and CS. Assign equal halves of this address space to the two departments.

(3) You want to start a new department, Floriology, and assign it an unused address range. You foresee that no more than 50 people will enroll. Assuming one address per person, what prefix would you assign to it?