Computer Networks WS20/21

Exercise 6

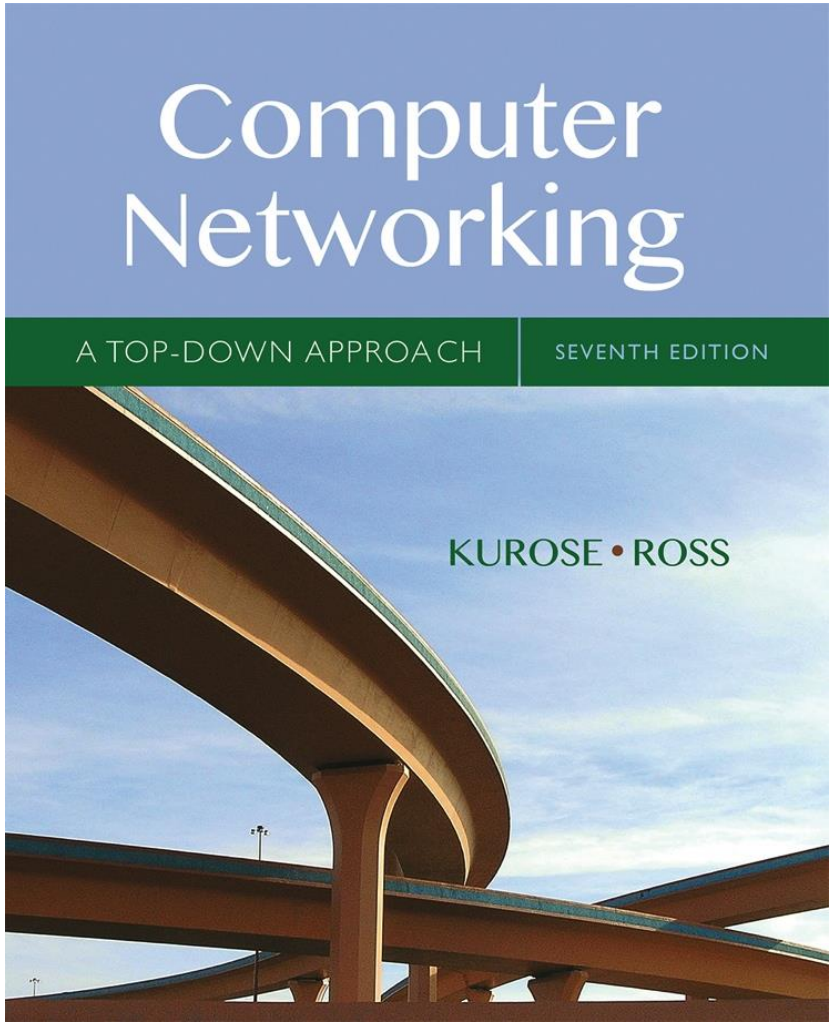
Recommendation

Try to borrow (or buy) this book:

Computer Networking: A Top Down Approach

7th edition. Jim Kurose, Keith Ross, Pearson, 2019.

It is very good to understand!



Routing policies

- Q1: How are routing policies used in BGP. Give one example.
- Routing policies determine …
  - … which BGP advertisements to regard
  - … which routes to advertise
- Example
  - AS x is connected to AS y and AS z
  - Policy : AS x does not want AS y to route traffic via AS x to AS z
  - Therefore, AS x does not advertise any route to reach AS z to AS y

Broadcast VS. Multicast

- Q2: What is the difference between broadcast routing and multicast routing?

- **Broadcast routing** delivers data to all hosts in a particular network
- **Multicast routing** delivers data to a subset of hosts in a particular network

Joining a multicast group

- Q3: What are the two steps that are involved in joining a multicast group?

- (Local) Host informs local multicast router that it wants to join the group
  - E.g. IGMP
- (Wide area) Local router interacts with other routers to receive multicast stream
  - e.g. DVMRP, PIM

Multicast concepts

- Q4: Briefly explain the following concepts of multicast routing:

- (Minimal) Spanning tree
  - Spanning tree: Sub-graph that includes all nodes but only least number of edges so that all nodes are connected
  - Minimal spanning tree: spanning tree with minimal weight of edges (i.e. equal or less than any other spanning tree)

Multicast concepts (cont‘d)

- Shortest path tree
  - Spanning tree that minimizes path costs from given source to any other node
- Source-based tree
  - (Multicast) tree that is specific for any given source node
- (Group-) Shared tree
  - (Multicast) tree that is shared among different source nodes

Multicast concepts (cont‘d)

- Reverse path forwarding
  - Forwarding of a (multicast) packet only if it arrived on the same link that a node would use itself to send packets to the source
- Center-based tree
  - (Multicast) tree that is formed when participating nodes add links that connect them to a common source

Protocol Independent Multicast

- Q5. Compare the two multicast distribution scenarios in Protocol Independent Multicast (PIM).
- Which one is more suited for networks that only have a small ratio of routers that are interested in multicast routing?

Protocol Independent Multicast

Two Scenarios:

- Sparse mode
  - Membership upon explicitly join request
  - Receiver-driven distribution tree (e.g., center-based)
  - Conservative bandwidth usage
  - Low processing requirements for non-group routers

- Dense mode
  - Membership “by default” until explicit prune
  - Data-driven distribution tree (e.g., RPF)
  - Increased bandwidth usage
  - Considerable processing requirements for non-group-routers

Protocol Independent Multicast

- Q: Which one is more suited for networks that only have a small ratio of routers that are interested in multicast routing?

- Sparse mode, as it puts less strain on the non-involved nodes in the network.

Mobility

- Q6: Considering mobility, compare the direct routing approach with the indirect routing approach in terms of location privacy, deployability (i.e. which nodes need to be upgraded), and robustness (i.e. what happens if the mobile node moves).

Mobility

- Location privacy
  - Direct routing: Correspondent node gets informed about current care-of-address of mobile node
  - Indirect routing: Correspondent node only knows home address of mobile node
- Deployability
  - Direct routing: Needs to be supported by Correspondent node and mobile node
  - Indirect routing: Needs to be supported only by mobile node
- Robustness
  - Direct routing: Mobile node needs to notify home agent as well as every correspondent node
    - What happens if correspondent node hasn't established connection yet?
  - Indirect routing: Mobile node only needs to notify home agent

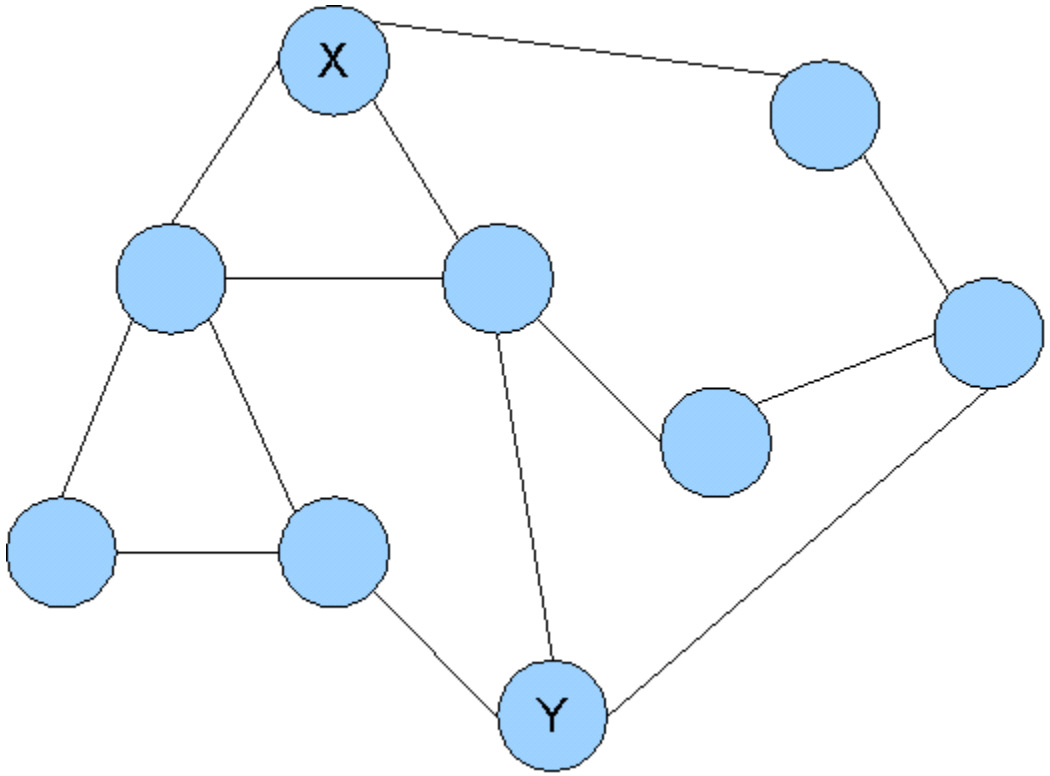
Agent discovery

- Q7. How does a mobile node discover a mobility agent in its current network and how can it obtain a care-of address?

- Agents (foreign agent & home agent) send out periodic ICMP messages (type 9)
  - They are called agent advertisement messages
- Advertisements of foreign agent include a list of available care-of addresses
  - Mobile node sends registration request for specific care-of address
  - Foreign agent acknowledges with registration reply message

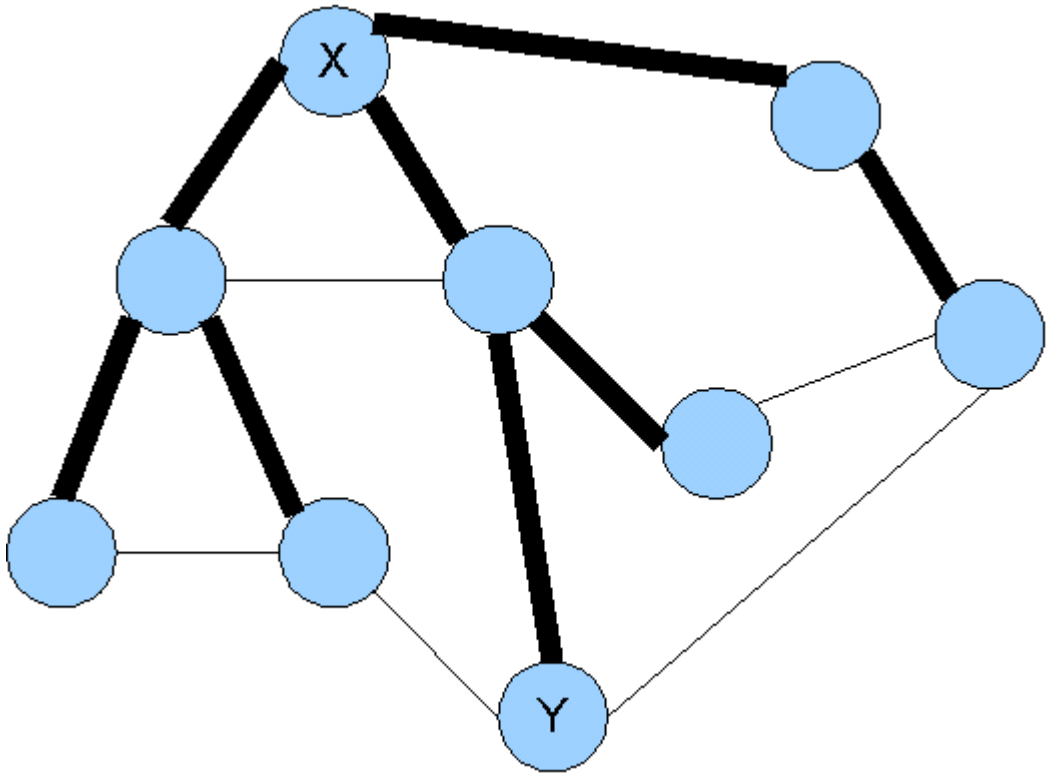
Reverse Path Forwarding

- Q8: Given the following network, use Reverse Path Forwarding to create a distribution tree with router X as the source. What happens if router Y does not have any attached nodes that are interested in the multicast data?
  - You can assume that all links have the same weight.



Reverse Path Forwarding (cont'd)

If router Y does not have any attached nodes that are interested in the multicast data, it will send a PRUNE message to its upstream node excluding itself from the tree



Any Questions?

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