Telematics Homework #5

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Broadcast and multicast routing

o Q: What is the difference between broadcast routing and multicast routing?

o Broadcast routing delivers data to all hosts in a particular network

o Multicast routing delivers data to a subset of hosts in a particular network

Packet duplication

o Q: What are the different methods for packet duplication in multicast routing? Explain the advantages and disadvantages.

o Source duplication

  o + No support from the network required

  o - Duplicate packets on the same links

  o - Source might not know the recipients (esp. broadcast routing

Packet duplication (cont'd)

o In-network duplication

  o + No duplicate packets on the same link(s)

  o - Network support required

o Application level duplication

  o + No network support required

  o - Might have duplicate packets on the same link(s)

Multicast concepts

o Q: Briefly explain the following concepts of multicast routing:

o (Minimal) Spanning tree

   o Subgraph that includes all nodes but only least number of edges so that all nodes are connected

   o Minimal spanning tree: spanning tree with minimal weight of edges (i.e. equal or less than any other spanning tree

Multicast concepts (cont'd)

o Shortest path tree

    o Spanning tree that minimizes path costs from given source to any other node

o Source-based tree

    o (Multicast) tree that is specific for any given source node

o (Group-) Shared tree

    o (Multicast) tree that is shared among different source nodes

Multicast concepts (cont'd)

o Reverse path forwarding

   o 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

o Center-based tree

   o (Multicast) tree that is formed when participating nodes add links that connect them to a common source
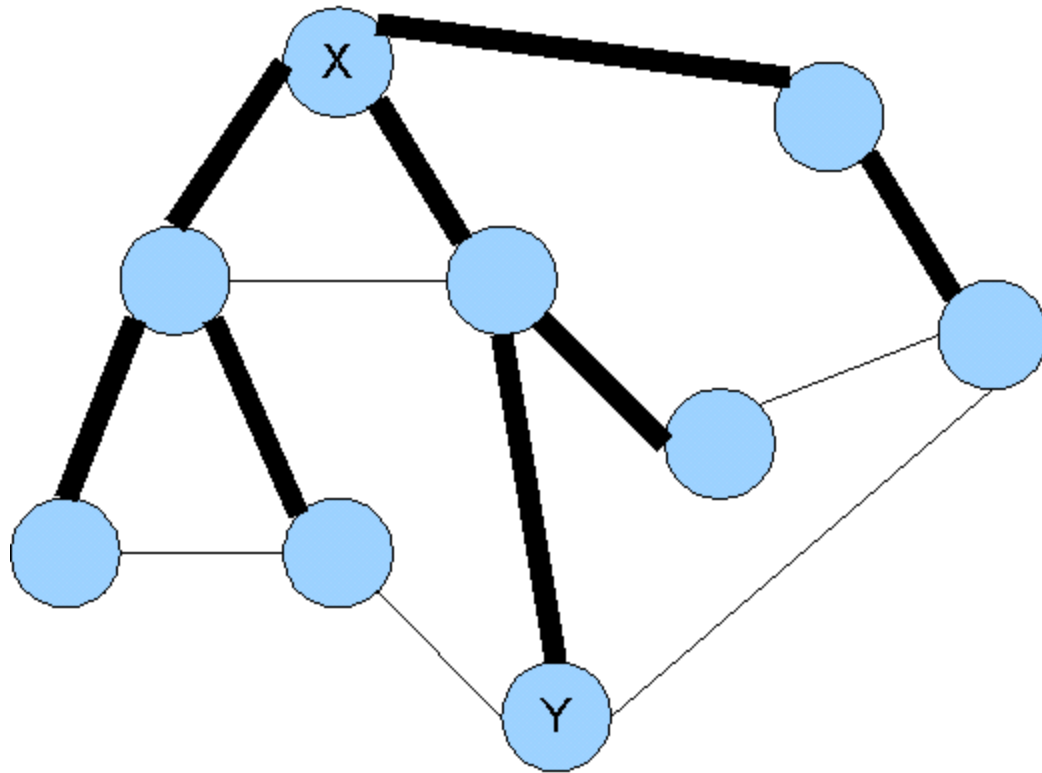
Reverse Path Forwarding

o Q: 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?

 o You can assume that all links have the same weight.

Reverse Path Forwarding (cont'd)
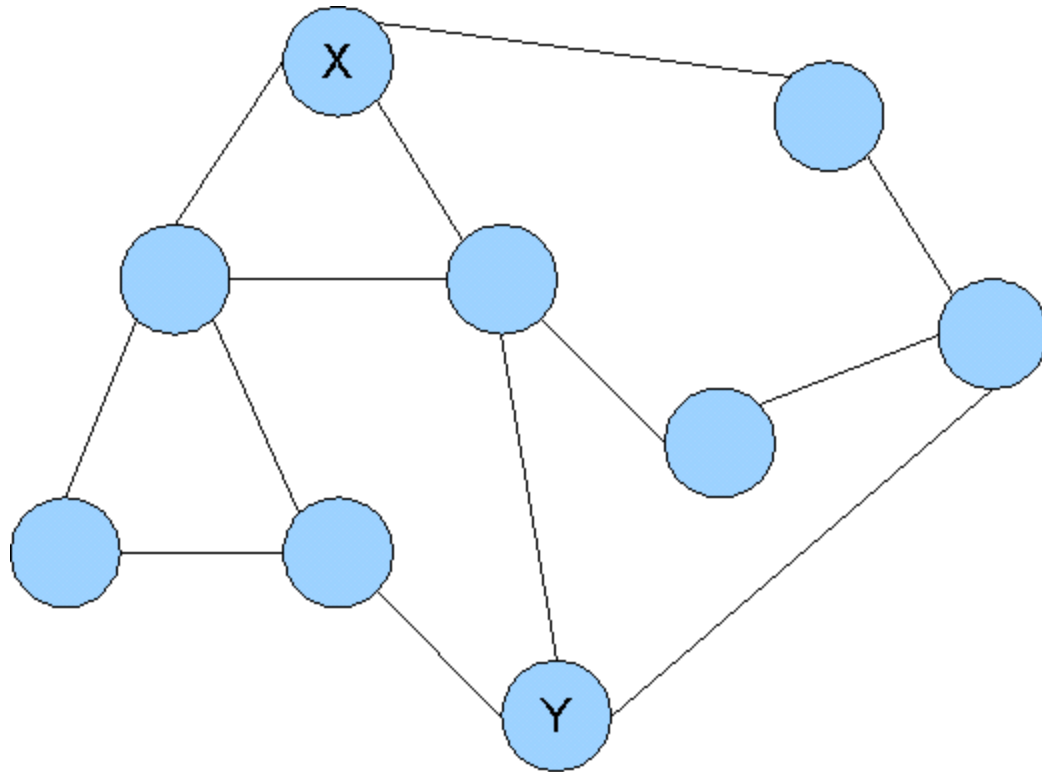
Reverse Path Forwarding (cont'd)

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 it upstream node excluding itself from the tree
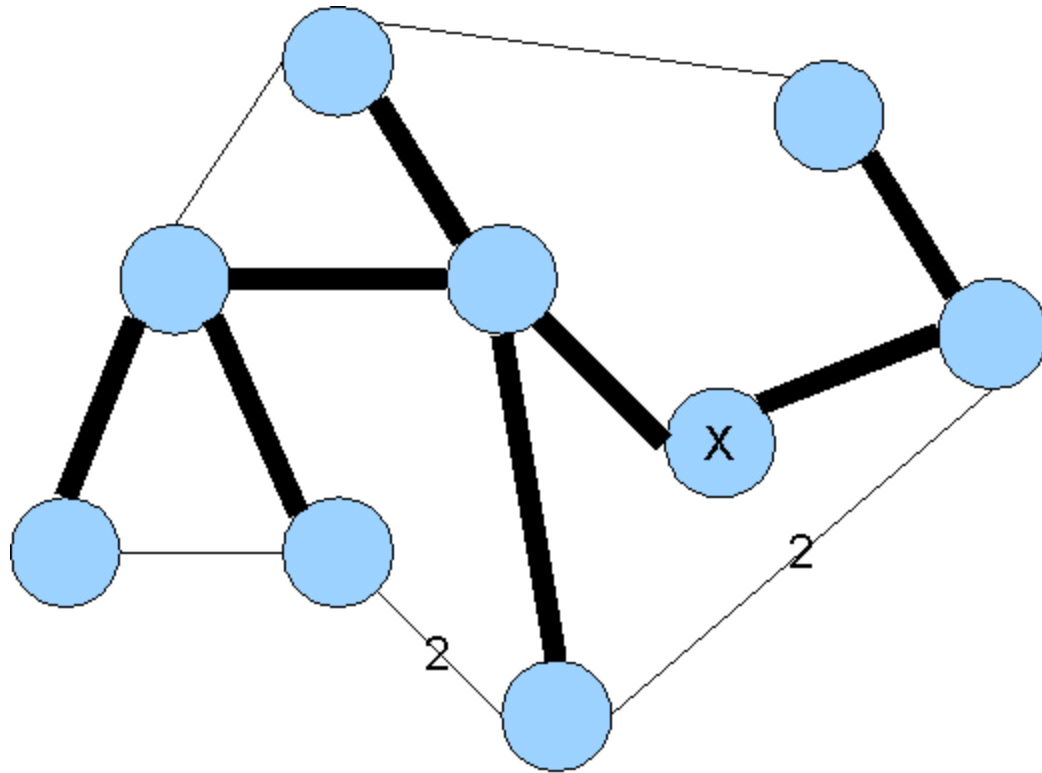
Center-based distribution tree

o Q: Given the following network, create a center-based distribution tree using router X as the center.

  o Unless noted otherwise, all links have a weight of 1.

Center-based distribution tree (cont'd)
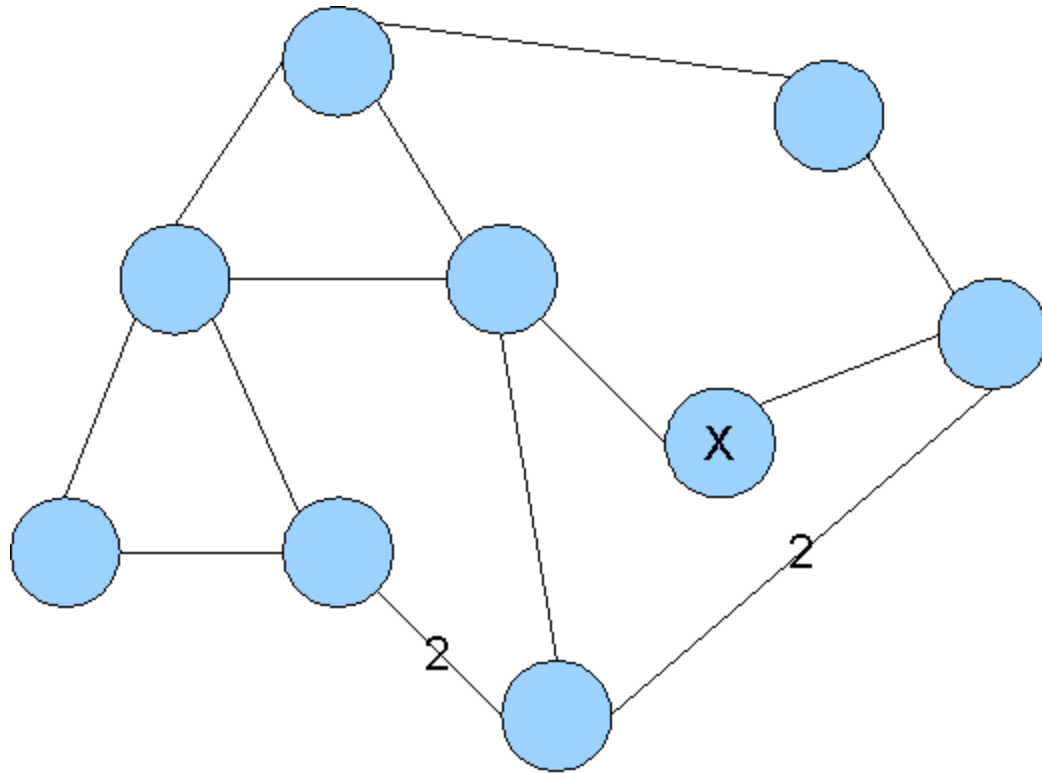
Center-based distribution tree (cont'd)

Protocol Independent Multicast

○ Q: Compare the two multicast distribution scenarios in Protocol Independent Multicast (PIM).

○ 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

Protocol Independent Multicast (cont'd)

- 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

Mobility

o Q: Explain three basic approaches to mobility. Name their advantages and disadvantages.

o Routing-based
  o Routers is responsible for mobility management
  o Routers advertise path to mobile node via usual routing table exchange
  o Routing tables indicate where mobile node is located
  o + No changes to end-systems
  o -- Does not scale well

Mobility (cont'd)

o Host-based (indirect routing)

- o Home agent relays data between correspondent node and mobile node

- o Mobile node has a permanent address that is routed through home agent

Mobility (cont'd)

o Host-based (indirect routing)

   o + No exposure of current location of mobile node

   o + No changes to the corresponding node

   o + Ongoing connections can be maintained when mobile node moves

   o - Inefficient routing (triangular routing)

   o - Changes to end host

   o - Home agent is bottleneck

Mobility (cont'd)

- Host-based (direct routing)
    - Correspondent node gets current address of mobile node from its home agent
    - Correspondent node communicates directly with mobile node

Mobility (cont'd)

- Host-based (direct routing)
  - + Efficient routing
  - + Home agent isn't a bottleneck

  - - Exposure of current location of mobile node
  - - Changes to the corresponding node as well as mobile node required
  - - Difficult to maintain ongoing connections when mobile node moves

Mobile IP

o Q: Name the entities involved in a mobility scenario using Mobile IP and briefly explain their function.

o Home agent

- o Maintains permanent address for mobile node (home address)
- o Handles binding of permanent address to care-of address

Mobile IP (cont'd)

- Foreign agent
    - Maintains current address for mobile node (care-of address)
    - Registers care-of address with home agent

- Mobile node
    - The host which requires mobility support

- Correspondent node
    - The host which communicates with the mobile node

Agent discovery

o Q: How does a mobile node discover a mobility agent in it's current network and how can it obtain a care-of address?

o Agents (foreign agent & home agent) send out periodic ICMP messages (type 9)

 o They are called agent advertisement messages

Agent discovery (cont'd)

o Advertisements of foreign agent include a list of available care-of addresses

   o Mobile node sends registration request for specific care-of address

   o Foreign agent acknowledges with registration reply message

Thank you

Any questions?