Lecture 18

CS625: Advanced Computer Networks
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Multicast Semantics

- Multicast group id/address
- Group semantics:
  - Sender does not know receiver set
  - Any receiver can belong to (m)any group(s)
  - Open group
  - Leave/join independently
- Delivery semantics:
  - Scoped possible
  - Best-effort

Topic for Today

- Multicast
- Scribe for today?

Performance Criteria

- Efficient data delivery
  - Minimize bandwidth usage
  - Minimize delay
- Reduce control overhead
  - Bandwidth
  - State at routers
- Minimize join latency
**Multicast in LAN**

- A set of ethernet addresses are multicast addresses
- Since medium is broadcast, can filter

**Multicast in Extended LAN**

- Extended LAN: spanning tree protocol among bridges
  - Root bridge
  - Shortest-path tree rooted at root
  - Forwarding tables maintained based on packets seen
- For multicast:
  - Hosts send membership requests
  - Forwarding based on such received requests

**Multicast in DV-routed Network**

- Unlike bridged LAN, no single tree is suitable
- Series of steps:
  - Reverse Path Flooding (RPF)
  - Reverse Path Broadcasting (RPB)
  - Truncated RPB (TRPB)
  - Reverse Path Multicasting (RPM)

**Reverse Path Flooding (RPF)**

- Packet from source is sent
  - If it is from shortest-path to sender
  - Along all other links
- Packet can be duplicated on a link in such a case
Reverse Path Broadcast (RPB)
- Designate parent node for each link
  - Node with shortest-path to sender
  - Break ties arbitrarily
- A node sends only along child links
- Truncation: TRPB
  - Leaf link: no other router uses to reach the source
  - Truncate at leaves
  - Each router says "this is my next hop link to source"

Reverse Path Multicast (RPM)
- Start with TRPB
- Routers may send Non-Membership-Reports (NMRs)
  - Propagated up the tree as necessary
  - NMR state is timed out if not refreshed
  - NMR cancel on demand
- Overhead:
  - Per (group X sender) state at each node

Multicast in Link-State Routed Network
- Straightforward extension of link-state
  - Link-state also includes group presence info
    - Only local membership reporting necessary
    - Propagation through the network using flooding
  - Each router can compute the shortest-path tree from any source
  - Trees can be computed on demand, and only forwarding entries stored
  - Storage cost: O(groups X senders)

Hierarchical Multicast
- Can extend previous algorithms hierarchically
- Need each sub-domain to act as a broadcast link
  - All multicast packets should reach all sub-domain and super-domain routers
  - Super-domain routers should be able to monitor group membership