

Lecture 18

CS625: Advanced Computer Networks
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<http://www.cse.iitk.ac.in/users/braman/courses/cs625-fall2004/outline.html>

Topic for Today

- Multicast
- *Scribe for today?*

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

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: $O(\text{groups} \times \text{senders})$

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