Broadcasting over Internet-II

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PIM-SM (protocol independent multicast – sparse mode)

- As per RFC4601
- Single shortest path spanning tree
- Rooted at some agreed node – Rendezvous point (RP)
  - The shared tree – called RPT
- To be used for all the group communications
- Independent of routing protocol
- Use unicast routing information base created by the routing protocol
- Alternatively can use multicast routing information base
  - created using unicast routing tables and mBGP.
Multicast states

- Forwarding states in routers
  - (*,*) - for all groups, from any source
  - (*,G) – for group G, from any source
  - (S,G) – for group G, from source S
  - (S,G,rpt) – for group G, from Source S, on rendezvous point tree
    - Usually this means that for child nodes specified for this entry, the packets from S for this group G are not forwarded
Phase-I: RP Tree

- Receiving endpoint request DR (designated router) – for subscription to G.
- DR creates state for (*,G) join
- DR send (*,G) to the router in direction of RP
For G in SSM multicast range (232.0.0.0-232.255.255.255)
- Any (*,G) join will be dropped
- Only (S,G) join is permitted

For any source multicast (ASM) (all multicast addresses other than SSM)
- (*,G) and (S,G) joins permitted
Register packets

- The source for multicast packets gives packets to its designated router
- The DR encapsulates the multicast packets in unicast packets
  - Protocol field for unicast IP packets is set to IP (IP in IP tunneling)
- The encapsulated packets sent to RP
What RP does?

- RP de-encapsulates the packets.
- Forwards them to nodes as per multicast forwarding table.
- RP initiates (S,G) join towards S (Phase-II: Register Stop)
When RP starts getting two copies of multicast packets

- Discards the encapsulated packets
- Send register stop message to DR of S
Routing rules

- Node have \((S, G)\) children \(C_1 = \{A, B, C\}\)
- Node also have \((*, G)\) children as \(C_2 = \{B, D, E, S\}\), \((S, G, \text{rpt})\) children as \(C_3\)
- If a packet received from shortest path to \(S\)
  - Packet forwarded to \((C_1 \cup C_2) \setminus \{S\}) - C_3\)
If packet received from shortest path to RP, but not from shortest path to S

- Forwarded to \( C2 - C3 \)
Phase -III : Shorest path tree

- Any router can optionally decide to send (S,G) join towards S
- (S,G) join reaches to some router already having (S,G) state, or to S
- The router receives two copies of each packet
- Router sends (S,G,rpt) prune towards RP
- The prune forwarded till it reaches a router which have at least one child having (*,G) but no (S,G,rpt) state
How RP is selected?

- Some of the routers in the network - configured to be candidates for being RP
- A Boot Strap Router through a simple election process
- Each candidate tells the BSR of its willingness to be RP
- BSR builds a RP-set and broadcast it periodically to all the nodes in network
- Every node uses hashing on group address to determine the RP for that group from the RP-set.
- There can be more than one RP
- Each group will have only one RP