IETF Prague

Multicast-only Fast ReRoute (MoFRR)

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Agenda

- Problem Statement
- Solution Statement
- Two-Plane Network Design
- Generalization to Non-ECMP
- Failure Detection
- IPR Disclosure

Problem Statement

- <50msec upon network outage

Solution Statement

- Fast switch-over on pre-installed secondary and disjoint path
- Optimized for simplicity
  - Similar trade-off to LFA FRR

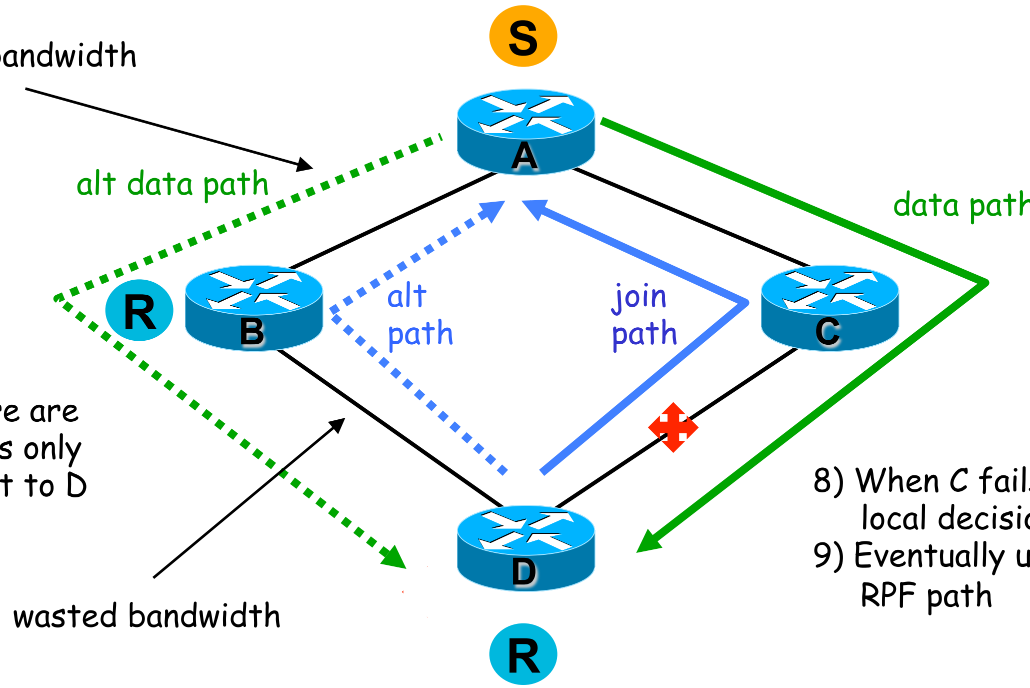
Advantages

- Incremental deployment at the edge, without core upgrade/specialization
- No planning for any extra backup bw
- No dependency on IGP convergence
- An alternative to source redundancy, but
  - Don't have to provision sources
  - Don't have to sync data streams
  - No duplicate data to multicast receivers

Disadvantages

- Topology dependent
  - Similar to LFA FRR
  - Not meant to be a generic solution for all topologies. Rather, a simple solution that applies to a frequent network design
  - Planning tool available to optimize topology for MoFRR
- Two behaviors
  - ECMP and non-ECMP

ECMP Example



7) If upstream of D there are receivers, bandwidth is only wasted from that point to D

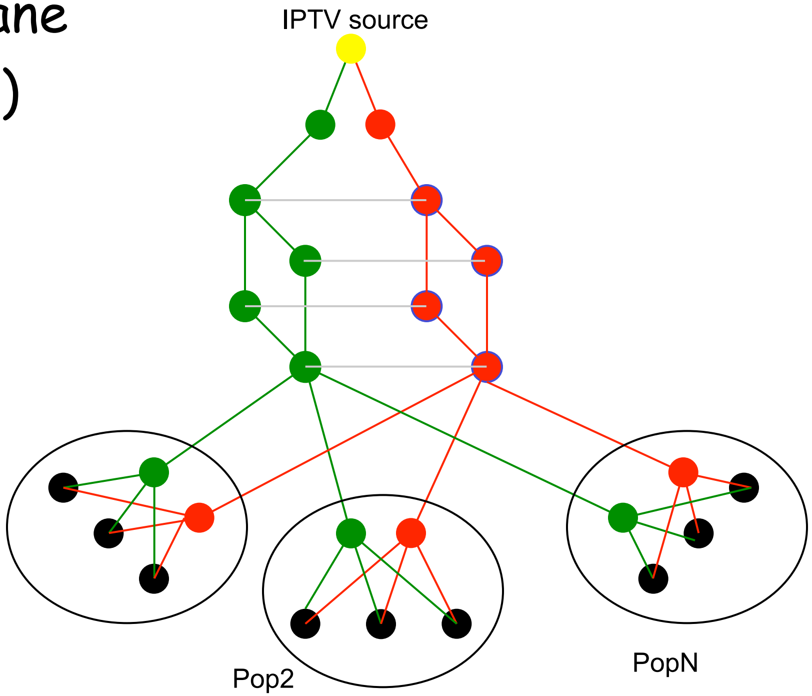
8) When C fails or DC link fails, D makes local decision to accept packets from B
9) Eventually unicast routing says B is new RPF path

- data path
- redundant path
- rpf path (RPF join)
- alt join (sent on non-rpf)
- link down or RPF-failed packet drop

1) D has ECMP path {BA, CA} to S
2) D sends join on RPF path through C
3) D can send alternate-join on BA path
4) A has 2 oifs leading to a single receiver
5) When RPF path is up, duplicates come to D
6) But D RPF fails on packets from B

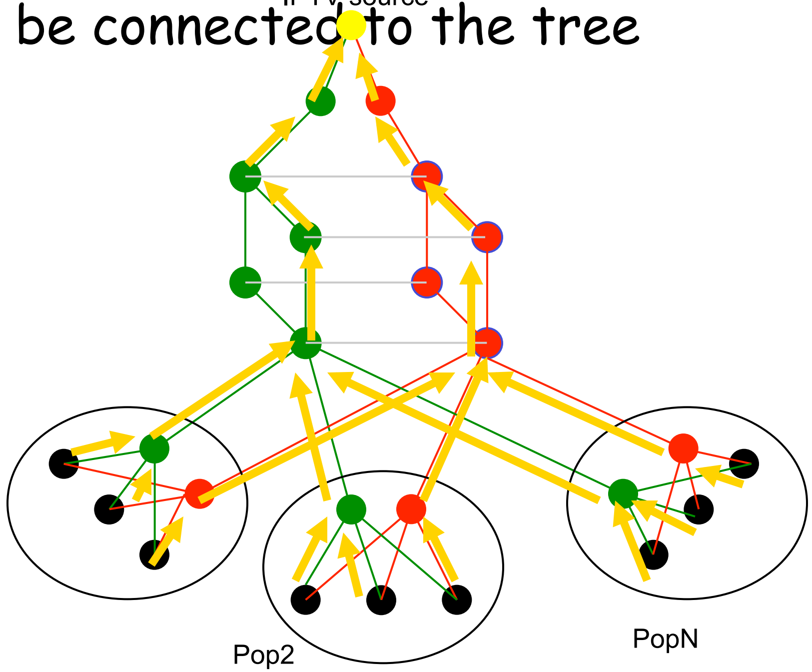
Two-Plane Network Design

- Many SP networks apply the Two-Plane Design
  - two symmetric backbone planes (green and red)
  - interconnected by grey links with large metrics to ensure that a flow entering the red plane goes all the way to its exit via the red plane
  - pop's are dual-homed to each plane
  - important content (IPTV source) is dual-homed to both planes



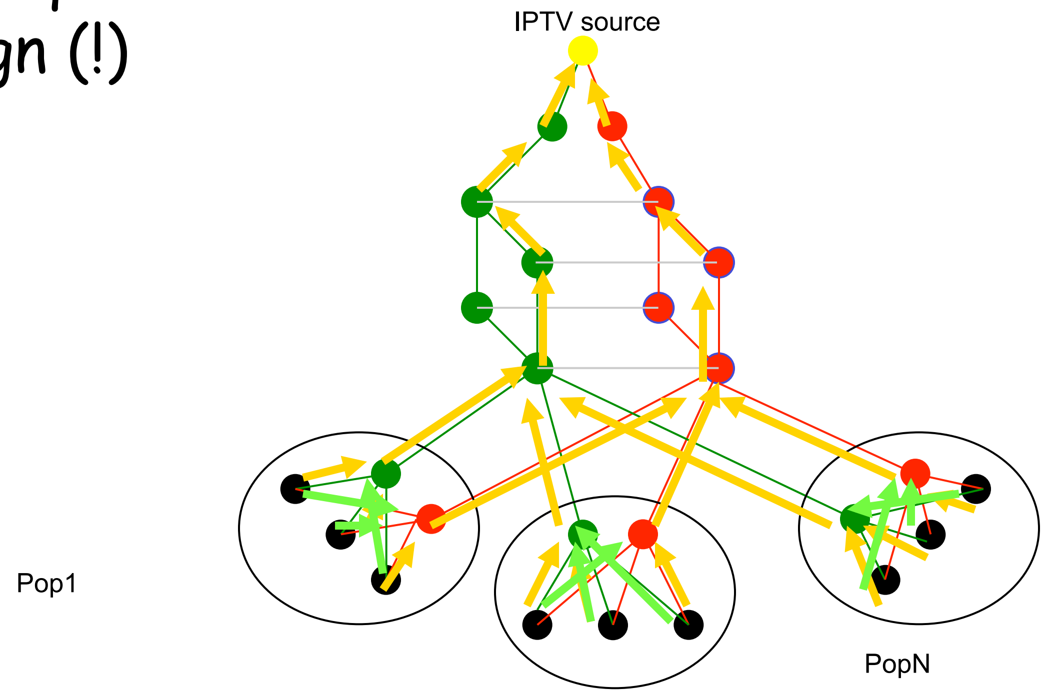
Two-Plane Network Design

- An IPTV SSM Tree for a premium channel is densely covering the two-plane design
- Dense trees : key to analysis. For IPTV, we assume there are many receivers
- From a capacity planning viewpoint, all Green and Red routers in a PoP are or must be assumed to be connected to the tree



MoFRR Applied to Two-Plane Network Design

- MoFRR only needs to be deployed on PE's (!)
- Does not create any additional capacity demand (!)
- Disjointness does not need to be created by explicit routing techniques. This is a native property of the design (!)



MoFRR Generalization to Non-ECMP

- Re-use LFA-FRR intelligence to choose a loop-free alternative
- Sends an additional PIM join to any IGP neighbor who is strictly closer to the source than you because you're sure that router will never send a join to you
  - If multiple candidates, leverage LSDB to choose the most disjoint candidate

MoFRR and Generic Topology

- Capacity Planning tool available to assess MoFRR coverage
- And optimize it
  - Topology changes
  - MoFRR deployment at core locations
- If the topology does not support natural disjoint paths, then extra cost and complexity need to be incurred (MT, RSVP) to create these disjoint paths.

Failure Detection Algorithm

- 50 ms MoFRR
  - IPTV Inter-packet Gap is O(1msec).
  - Monitor SSM (S, G) counter and if no packet received within 50msec switch onto the backup branch
  - Local detection with end-to-end protection!
- MoFRR Zero-Loss
  - IPTV flows to use RTP
  - MoFRR PE device to repair any loss thanks to RTP sequence match on the disjoint branch

Failure Detection Algorithm

- MoFRR based on RIB trigger
  - Upon failure along the primary path, IGP converges and the best path to the source is modified.
  - This triggers the use of the already-established MoFRR backup branch.
  - Gain over FC: no time incurred due to the building of the new branch
  - Target: subx00msec
- Connected link failure
  - This option makes sense when MoFRR is deployed across the network (not only at PE).

MoFRR and MPLS Transport

- MoFRR is as applicable to MLDP as to PIM

IPR Disclosure

- MoFRR Patent Application
  - Filed April 26, 2007
- MoFRR extensions for Ring Topologies
  - Filed February 12, 2008

Status

- MoFRR is deployed