MPLS-based multicast
A Service Provider perspective

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MPLS 2006

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Agenda

- Why MPLS multicast?
- How MPLS multicast works
- Service provider requirements

Why MPLS multicast?

- MPLS was not designed with multicast from day 1
  - P2P & MP2P only
- Clear requirements for multicast services
  - Corporate VPN
  - Broadcast TV
  - Finance sectors
- Convergence on MPLS (e.g. BT's 21C network)
- draft-rosen adds multicast to RFC4364 VPNs
  - Only supports IP/GRE forwarding not MPLS

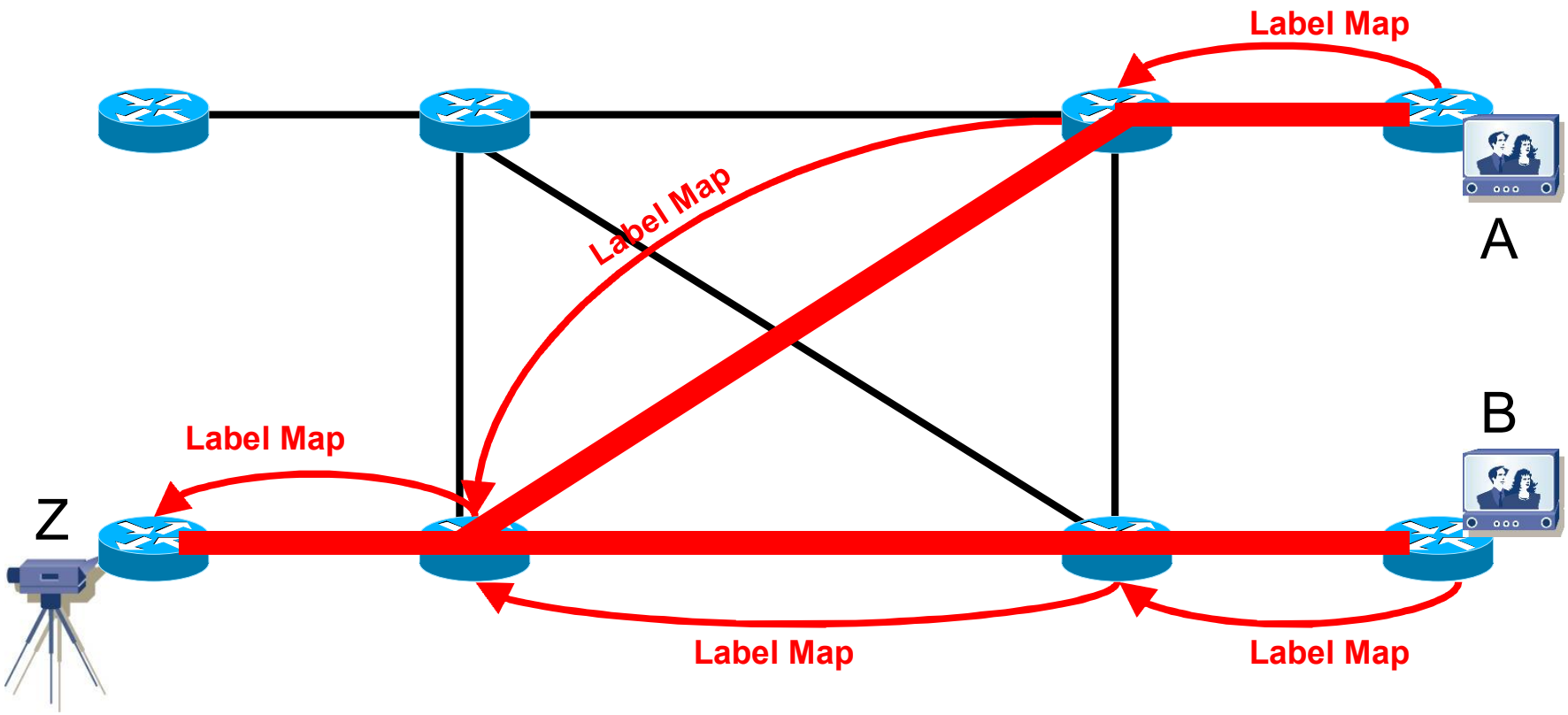
How MPLS multicast works

- Two solutions, depending on requirements:
- mLDP (multicast LDP)
  - Connectionless, receiver driven
- RSVP-TE
  - Connection-oriented, source driven

mLDP - Overview

- Defines a new P2MP FEC to identify P2MP LSPs
  - <Source IP Address of root, Opaque Value>
- Receiver (Leaf) initiates setup & tear down
- Supports
  - P2MP LSPs
  - MP2MP LSPs
  - Shared Trees
  - Make before break (optional)

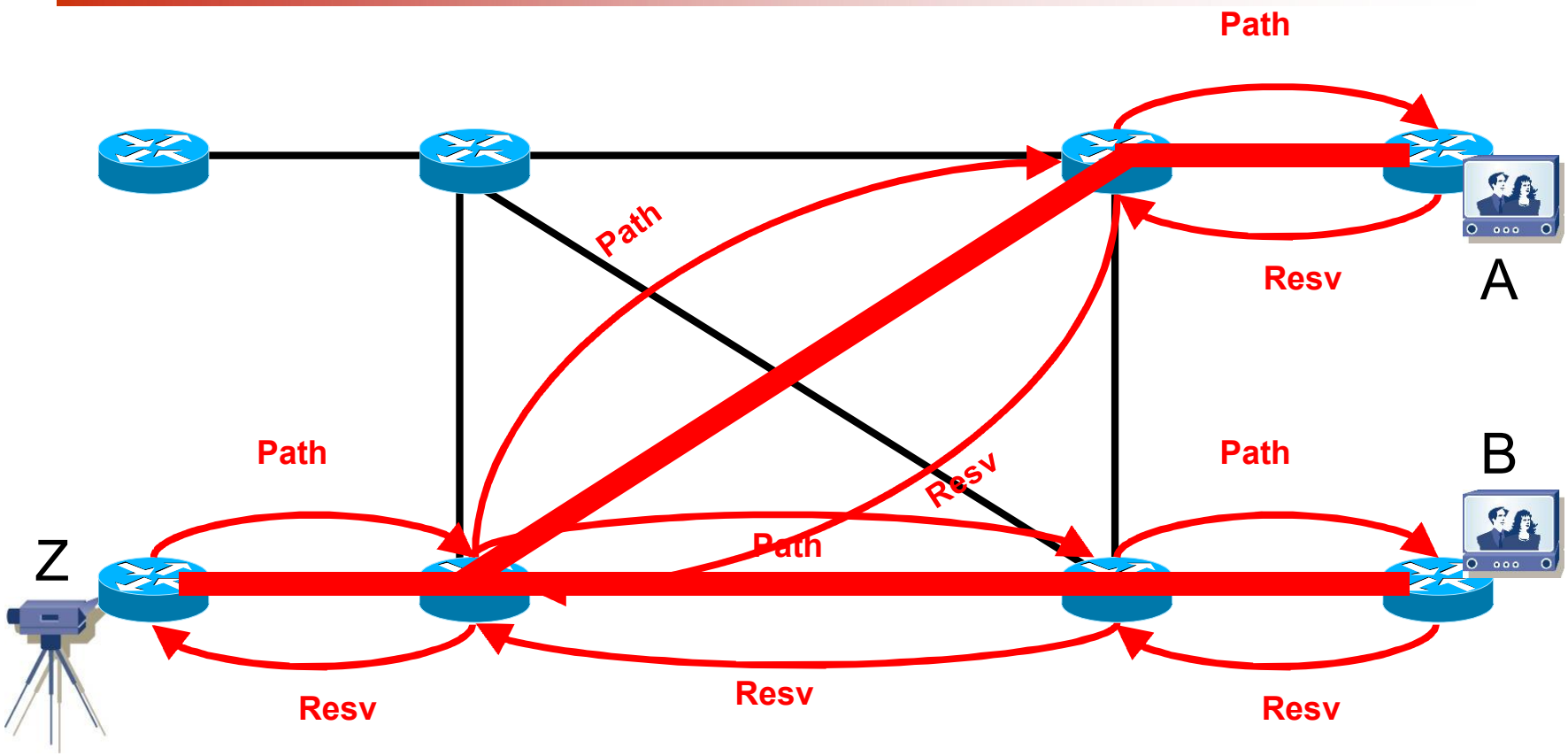
mLDP - Example



RSVP-TE - Overview

- MPLS & GMPLS
- Defines new P2MP SENDER_TEMPLATE
- P2MP LSP is constructed from one or more Source to Leaf (S2L) sub LSPs
- Source (Root) initiates setup & tear down
- Supports
  - P2MP LSPs
  - Shared Trees
  - Make before break
  - Refresh reduction [RFC2961]
  - Fast Reroute [RFC4090]

RSVP-TE - Example



Comparing mLSP & RSVP-TE

mLDP	RSVP-TE
Receiver driven and therefore root does not need to know a priori about the leaf nodes.	Head end driven and therefore the root has to know a priori about all the leaf nodes.
Multicast state is exactly the same as RSVP-TE, but the overhead of maintaining the state is lower.	Multicast state to be maintained is the same as mLDP, but the overhead of maintaining the state is higher.
Limited tree computation flexibility, no support for minimum cost trees.	Flexible path computation based on minimum cost and shortest path.
Hop by hop routing only, no explicit route support.	Hop by hop routing & explicit routing using ERO with strict and loose hops.
No support for bandwidth reservation in protocol but can be achieved using network planning & Diffserv.	Supports bandwidth reservation.
Backup path support reliant on IGP/LDP convergence. Optional make before break for planned events.	Supports fast reroute and make before break capabilities.

Service Provider requirements

- Ideally prefer a single protocol solution
- Seamless migration (from deployed solutions)
  - Converging onto a single 21C network platform
- Globally Scalable solution
  - 100s POP & >100 000 end user connections
- Multi-area & multi-AS support
- Management & operations that are as simple as possible
  - Due to network size and range of equipment
- Hard guarantees of performance characteristics
- Guaranteed 1+1 resiliency across diverse & separate paths
- Lowest latency path selection
- High availability
- Security (CESG approval)
  - Government & national infrastructure

How MPLS addresses these requirements (1)

- Multi-area & Multi-AS support
  - mLDP: Not covered by P2MP draft
  - RSVP-TE: Not covered by P2MP draft
- Simple management & operations
  - Management independent of protocol?
  - Reuse existing management tools?
- Hard guarantees of performance characteristics
  - mLDP: no support in protocol
    - Can be achieved via network planning, IGP modelling, Diffserv bandwidth assignment
  - RSVP-TE: support via TE metrics, bandwidth reservation and explicit routes

How MPLS addresses these requirements (2)

- Guaranteed 1+1 resiliency across diverse & separate paths
  - mLDP: no support in protocol
    - Can be achieved via network planning & IGP modelling
  - RSVP-TE: support via explicit routes
- Low latency path selection
  - mLDP: no support in protocol
    - Can be achieved via network planning & IGP modelling
  - RSVP-TE: support via TE metrics and explicit routes
- High availability
  - mLDP: RR draft & implementation dependent
  - RSVP-TE: FRR & implementation dependent

Room for improvement in MPLS multicast?

- Multi-vendor, interoperable implementations
  - Industry needs a single solution for multicast
  - Reduced to the lowest common denominator
- Reduce the no. choices in MPLS VPN multicast draft
  - For both control & data planes
  - draft-ietf-l3vpn-2547bis-mcast
- OAM
- High availability

Bibliography

- mLDP
  - draft-ietf-mpls-ldp-p2mp-01
- RSVP-TE
  - draft-mpls-rsvp-te-p2mp-06
- Multicast in MPLS/BGP IP VPNs
  - draft-ietf-l3vpn-2547bis-mcast-02
  - Supersedes draft-rosen-vpn-mcast-08 [Expired]
- BGP Encodings for Multicast in MPLS/BGP IP VPNs
  - draft-ietf-l3vpn-2547bis-mcast-bgp-00

Questions?