MCAST VPN
Overview

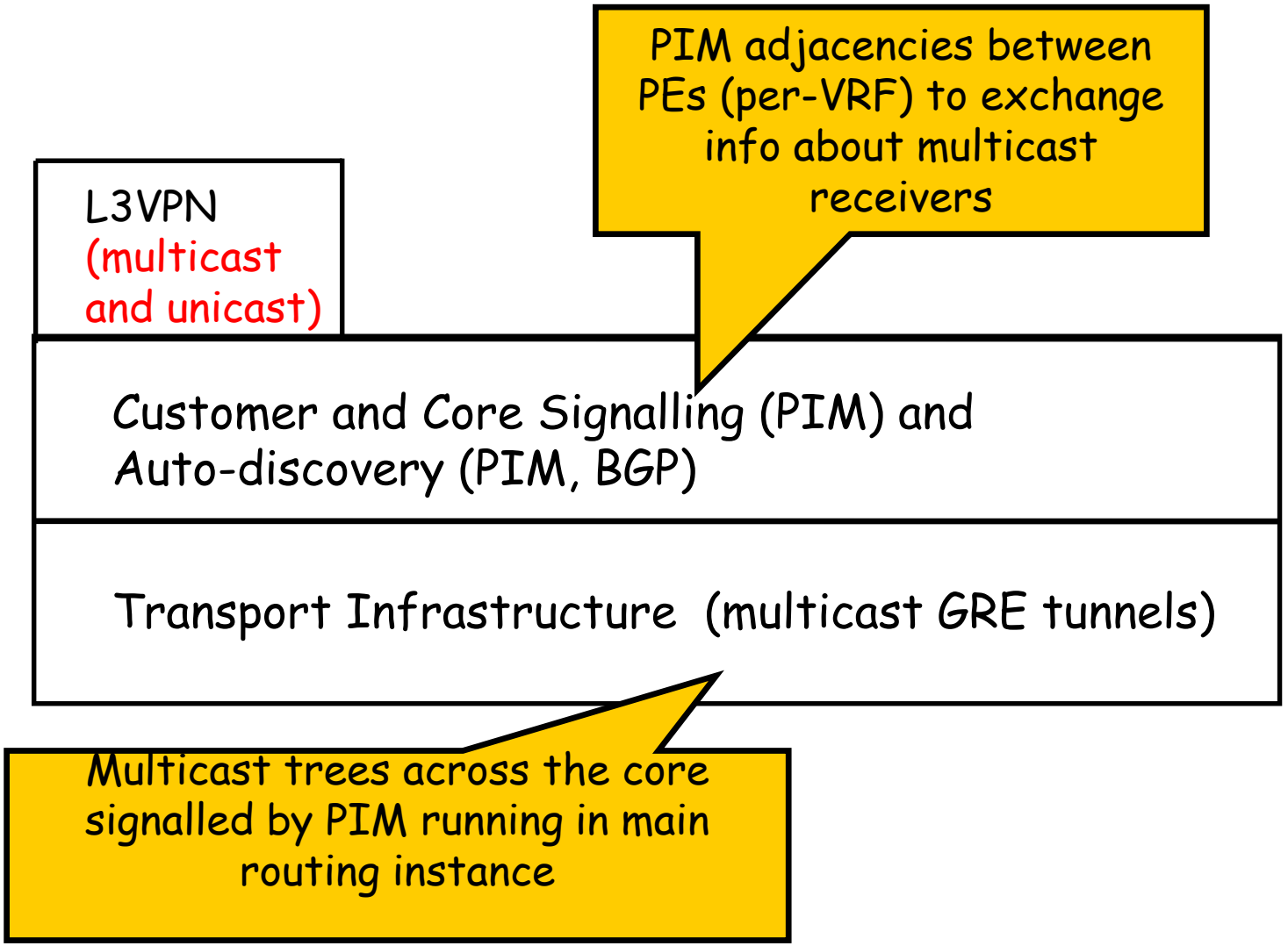
Multicast VPN

- Layer 3 BGP-MPLS VPNs are widely deployed in today's networks. RFC 4364, which supersedes RFC 2547, describes protocols and procedures for building BGP-MPLS VPNs for forwarding VPN unicast traffic only.
- An "incremental" approach for deploying Multicast services can use the same technology as used for deploying Layer 3 VPN for unicast services.
  - This approach can reduce the operational and deployment effort.
- As multicast applications, such as IPTV and multimedia collaboration, gain popularity
- There is demand for a scalable, reliable MVPN service

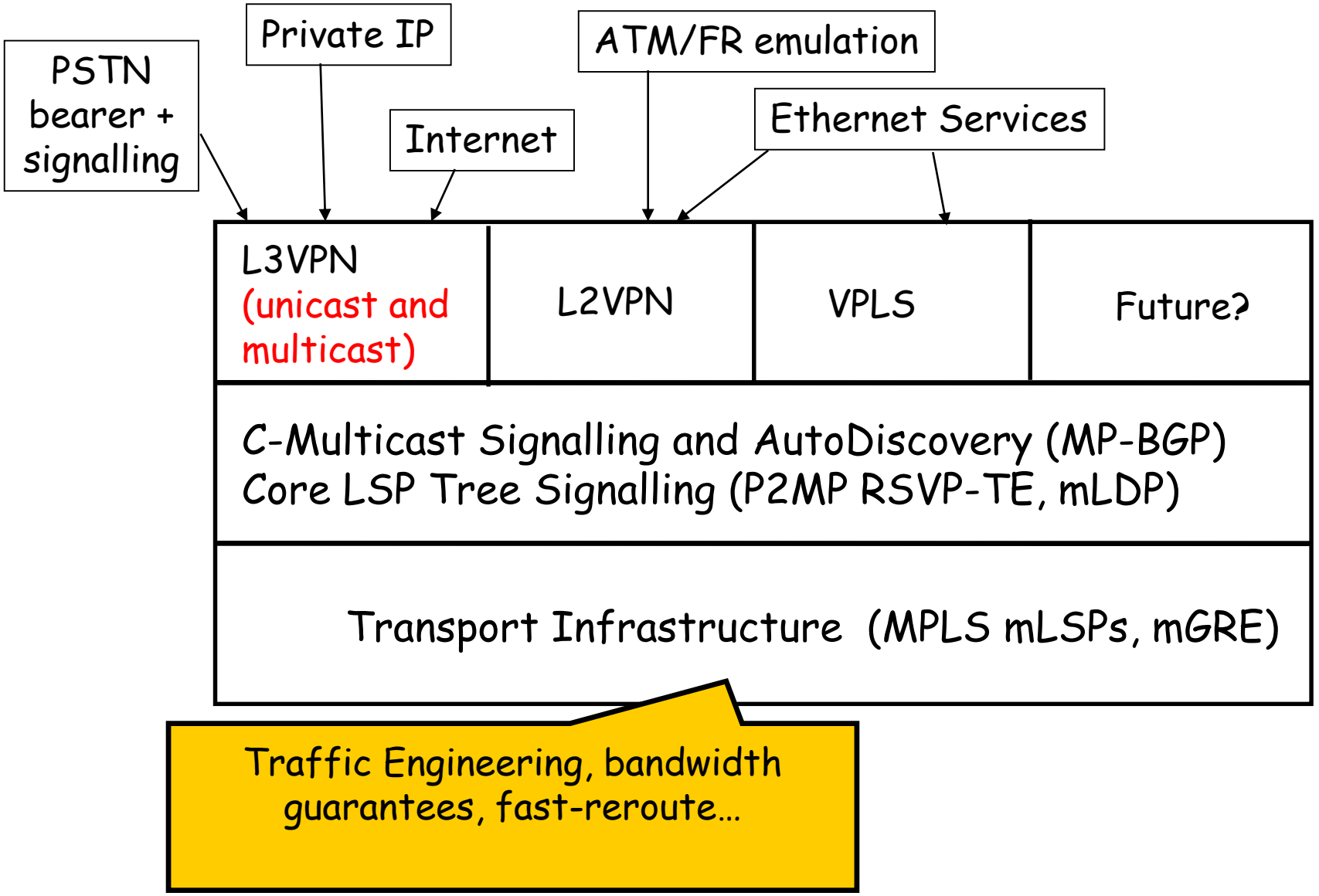
MCAST VPN Alternatives

- CE-CE GRE Overlay Tunnels
  - No multicast routing in the ISP's core
  - However customer's groups can overlap
  - Not scalable design – full mesh tunnels between CEs for each customer
  - Optimal multicast routing not achieved
- Rosen based Multicast VPN (or GRE based mVPNs)
  - Introducing Multicast VRF type
  - Based on native IP multicast (PIM SM/SSM mode) in the ISP's core network – customer's multicast is tunneled within ISP's core native IP multicast using multicast GRE tunnels
  - Customer's PIM adjancency with PE routers
  - Based on RFC 6037
- Next Generation Multicast VPN (or Labeled mVPNs)
  - In the past there was no way of carrying multicast traffic over MPLS but this all changed with the invention of "Point-to-Multipoint (P2MP) LSPs"
  - NG MVPN main architecture partially standardized and unified with Rosen based MVPNs in RFC 6513

Rosen mVPN Scheme

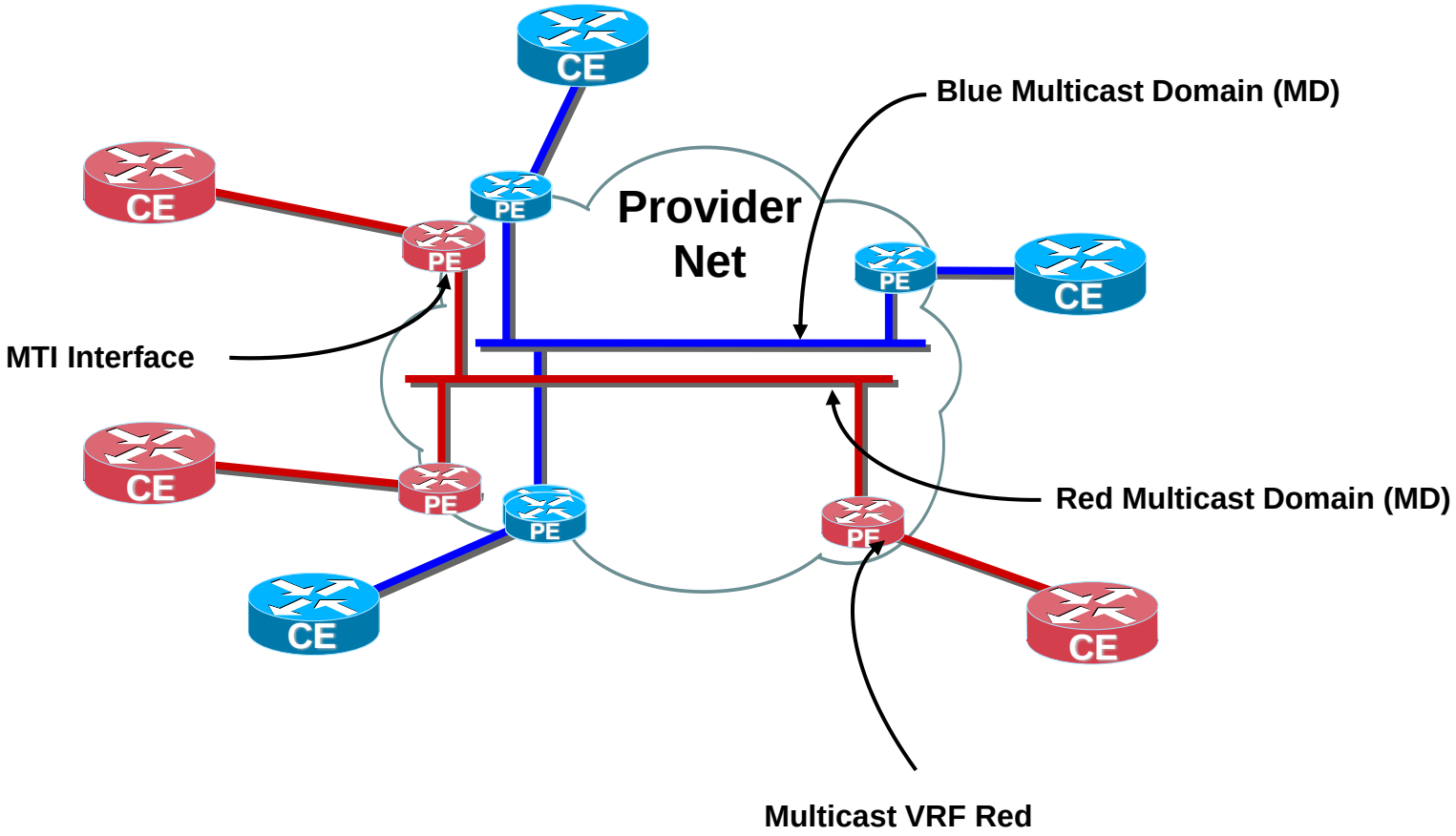


NextGen mVPN Scheme



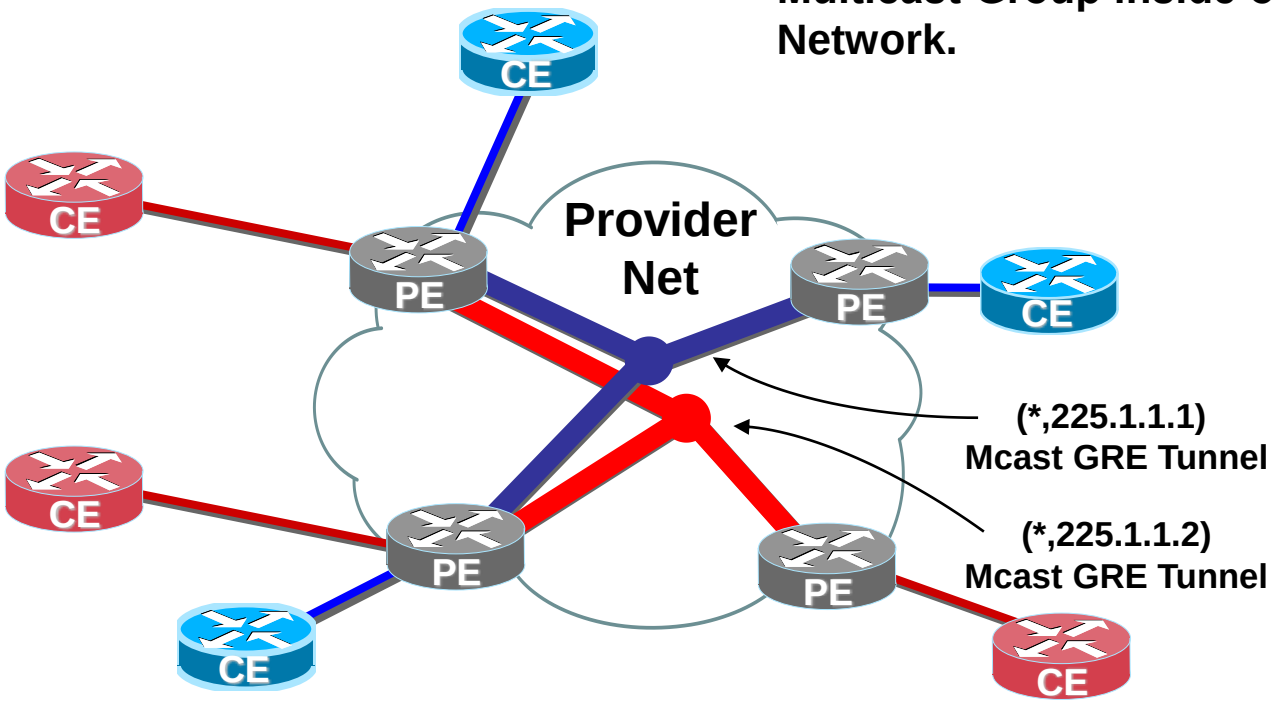
Rosen mVPN
Customer's Point of View

- Multicast Domain inside of Provider Network connects each MVPN
- All PE routers in the MD are PIM neighbors on MTI (MCAST Tunnel Iface)

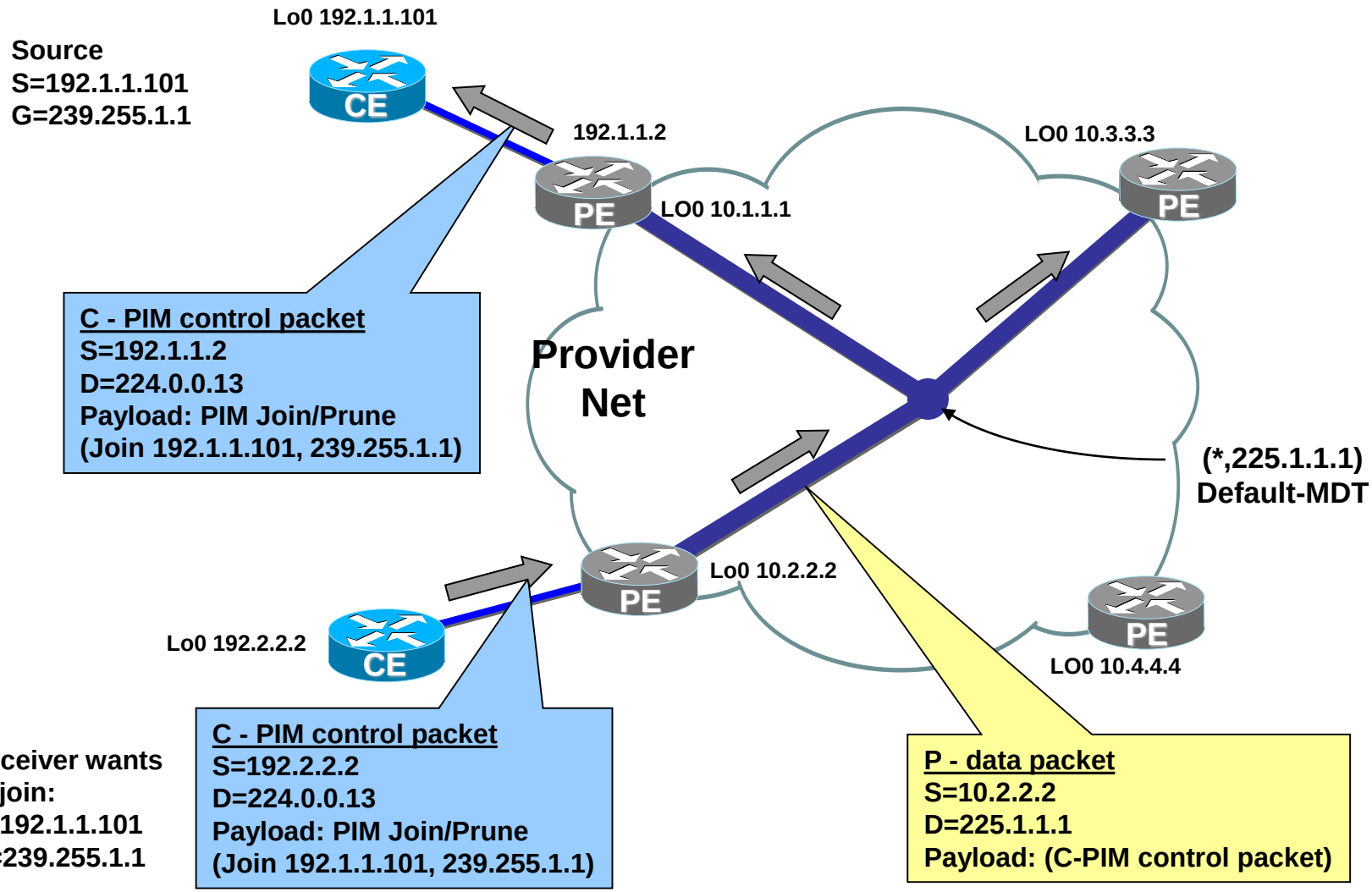


Rosen mVPN
Provider's Point of View

- Each Multicast Domain consists of a Default-MDT (Multicast Domain Tree).
- Each Default-MDT uses a separate Multicast Group inside of Provider's Network.

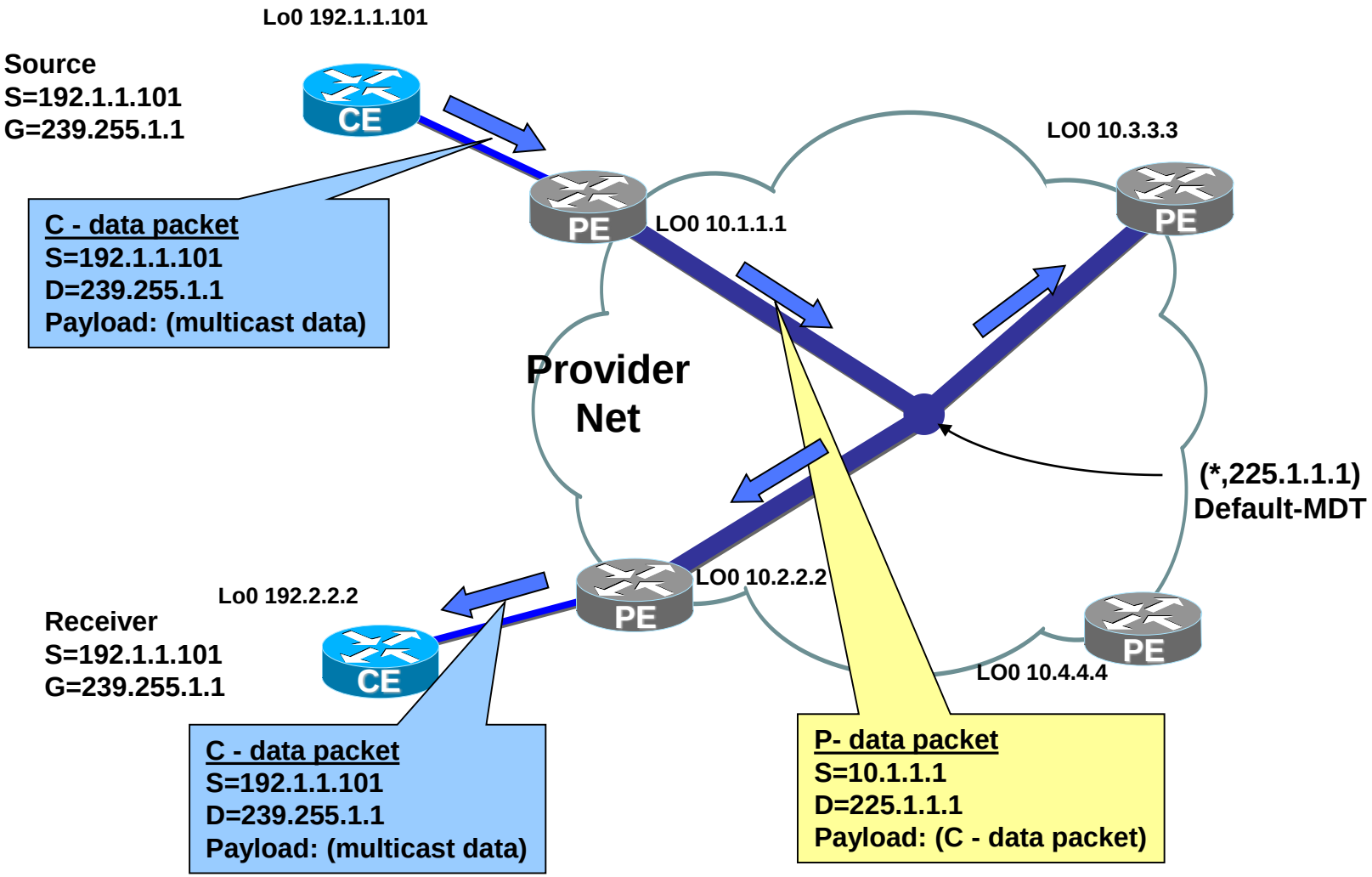


Default MDT - PIM SSM Control Traffic Flow

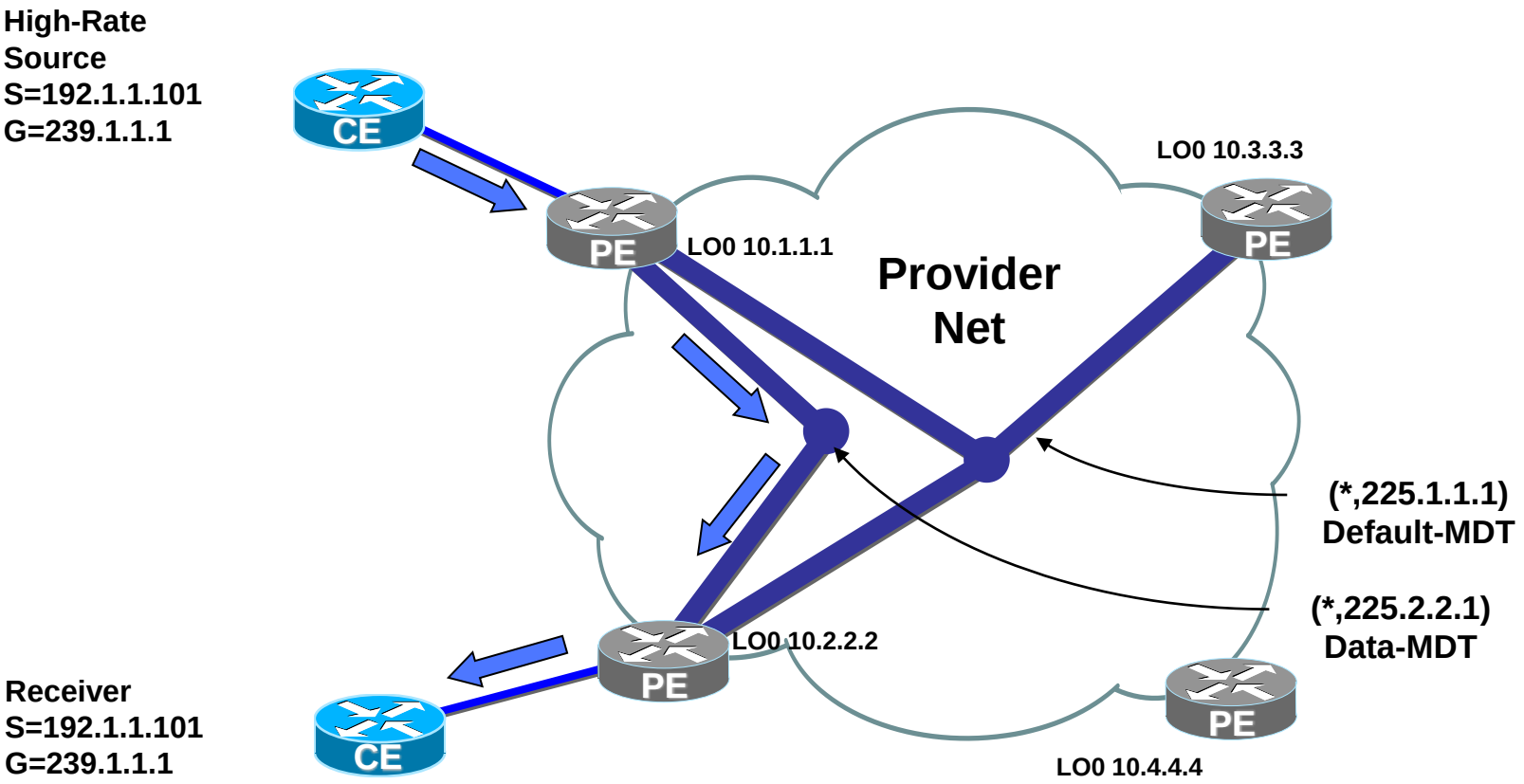


224.0.0.13 Well known IP for PIM Version 2

Default MDT – Multicast Data Traffic Flow



Data MDTs – Concepts



- High-rate data begins flowing via Data-MDT
- Data only goes to PE routers that have active receivers for that group

Rosen mVPN Issues

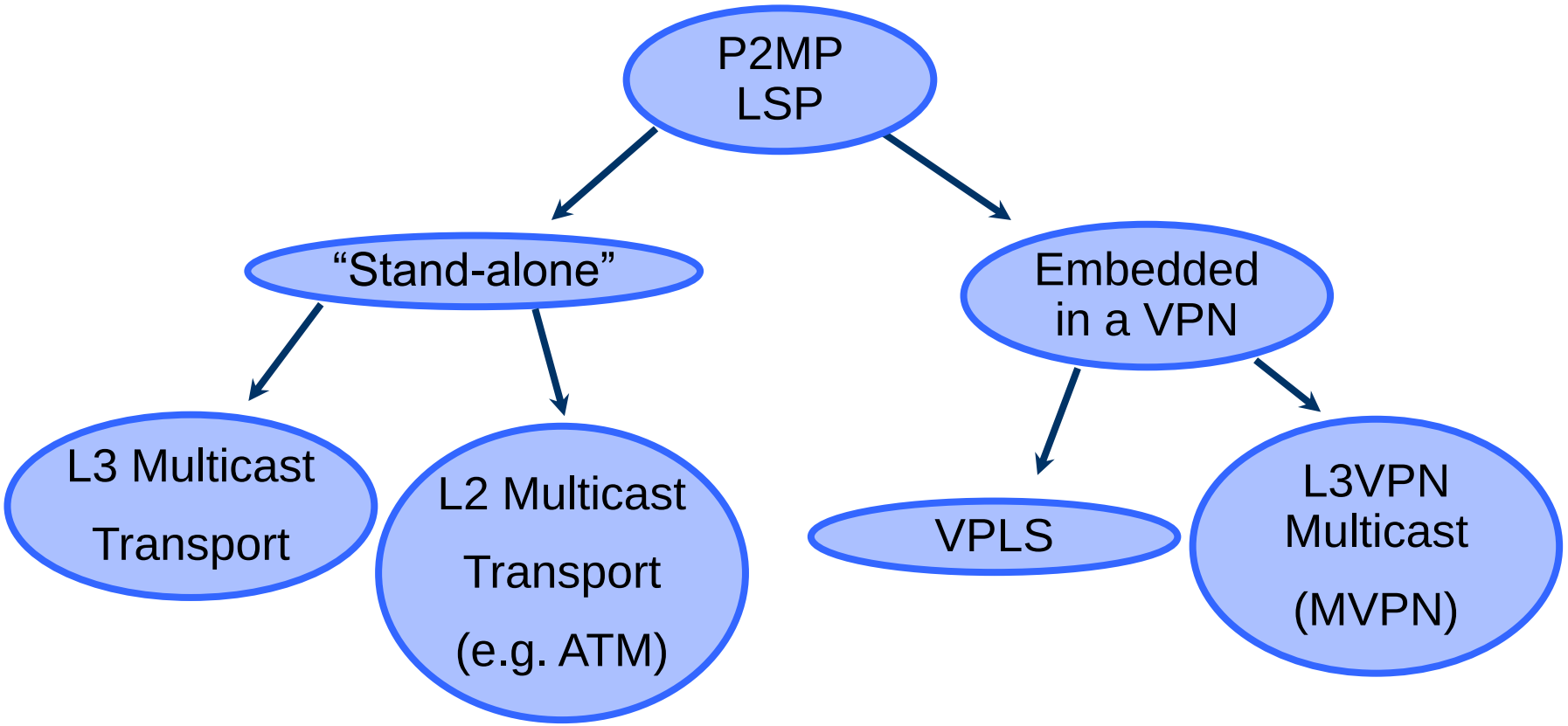
- **Each PE has to maintain PIM adjacencies with all other PEs for which it has at least one mVPN**. If m PEs have n mVPNs in common, then each such PE has to maintain m*n PIM adjacencies with the other PEs
- **No ability to aggregate multiple mVPNs** into a single inter-PE tunnel
- **No MPLS support**, just GRE tunnels, it means **P routers needs to be aware of customer's tunnels**
- **Convergence** the same as for native multicast
- **No Traffic Engineering** possibility

Next Generation Multicast VPN
What is Label Switched Multicast (MLS)?

IP multicast packets are transported using MPLS encapsulation. Unicast and Multicast share the same label space.

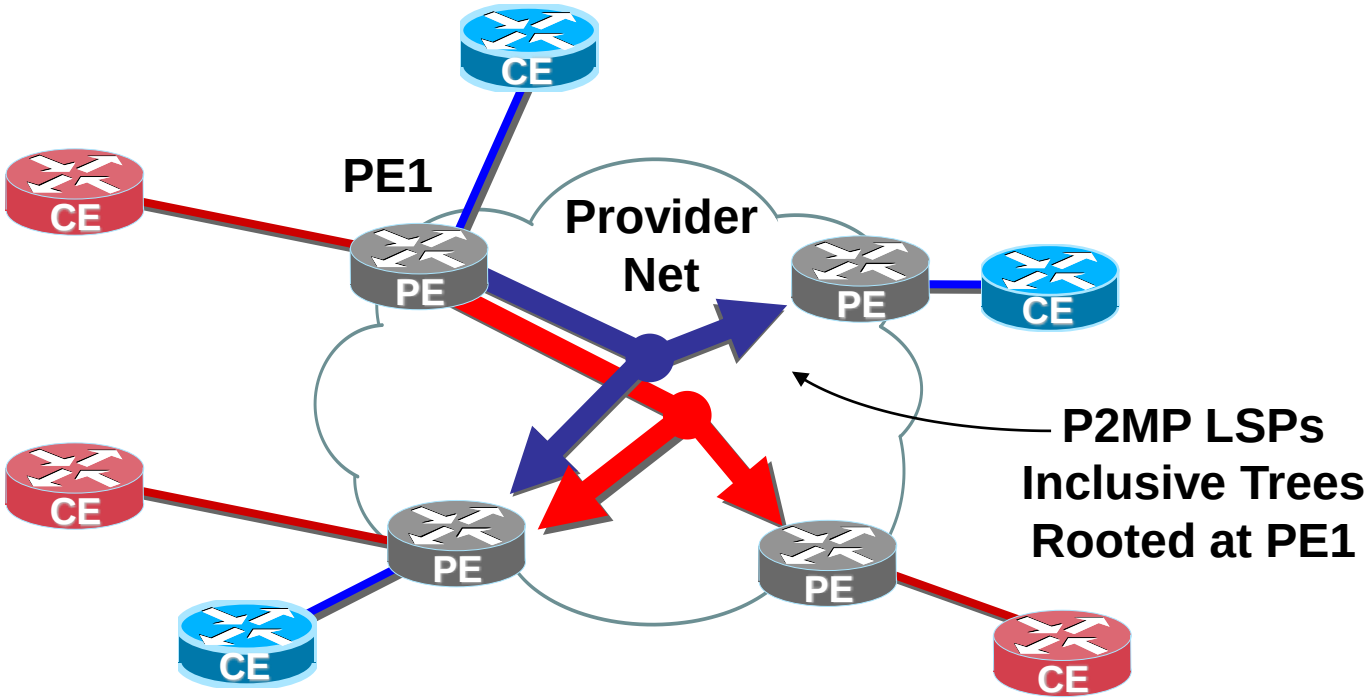
- NG-mVPN architecture proposes different types of multicast tree that could be used for data transmission
  - PIM-SM, PIM-SSM, PIM Bidir, P2MP LSP (RSVP TE signaled), P2MP LSP (mLDP signaled)
- Autodiscovery uses MP-BGP
  - Autodiscovery of PE neighbors, mVPN to tunnel mapping, PE-PE C-MCAST Route Exchange
- **PMSI** (Provider Multicast Service Interface) can be considered as the pseudo interface that connects a PE that is in the sender sites set to the PEs that are in the receiver sites set.

Applications of P2MP LSPs



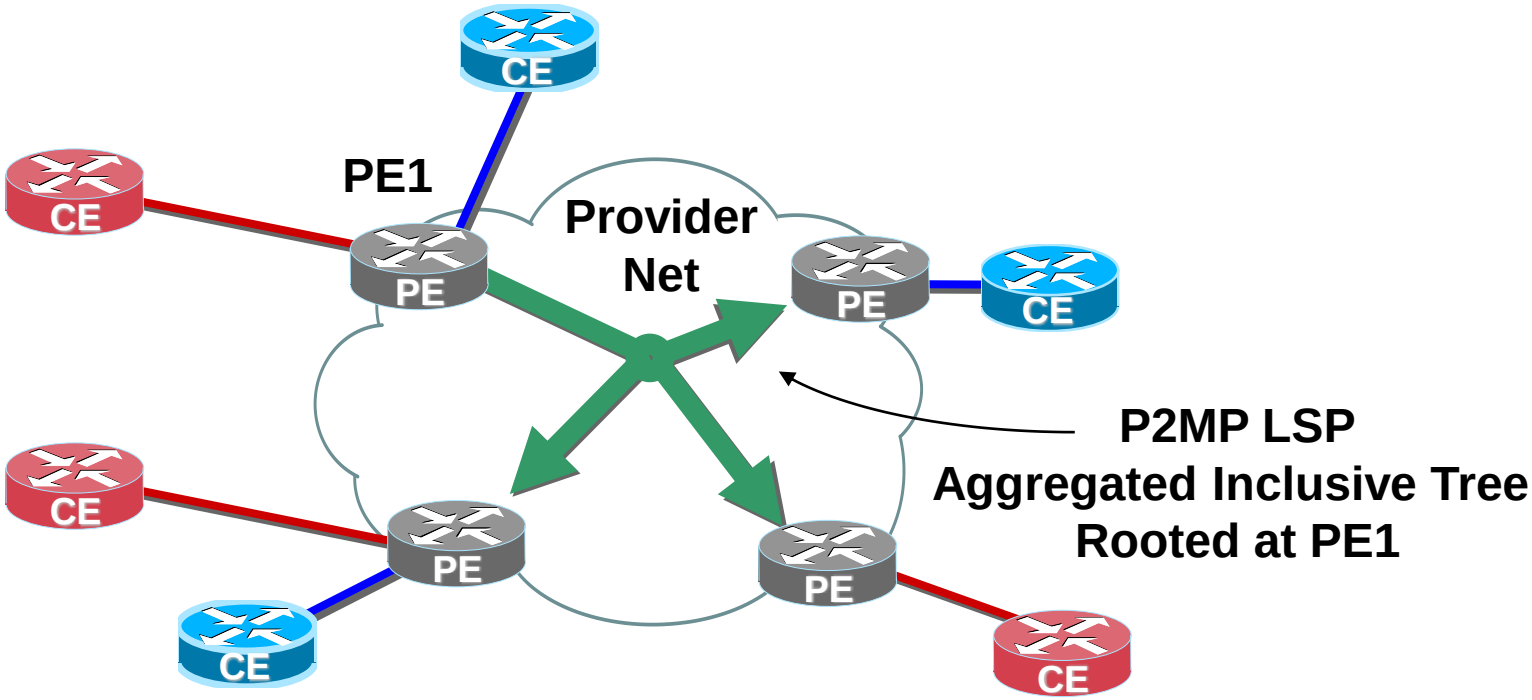
Provider Tree (P-Tree) types
Inclusive Tree

So called **Inclusive Trees** - analogous to Default-MDT in draft-Rosen



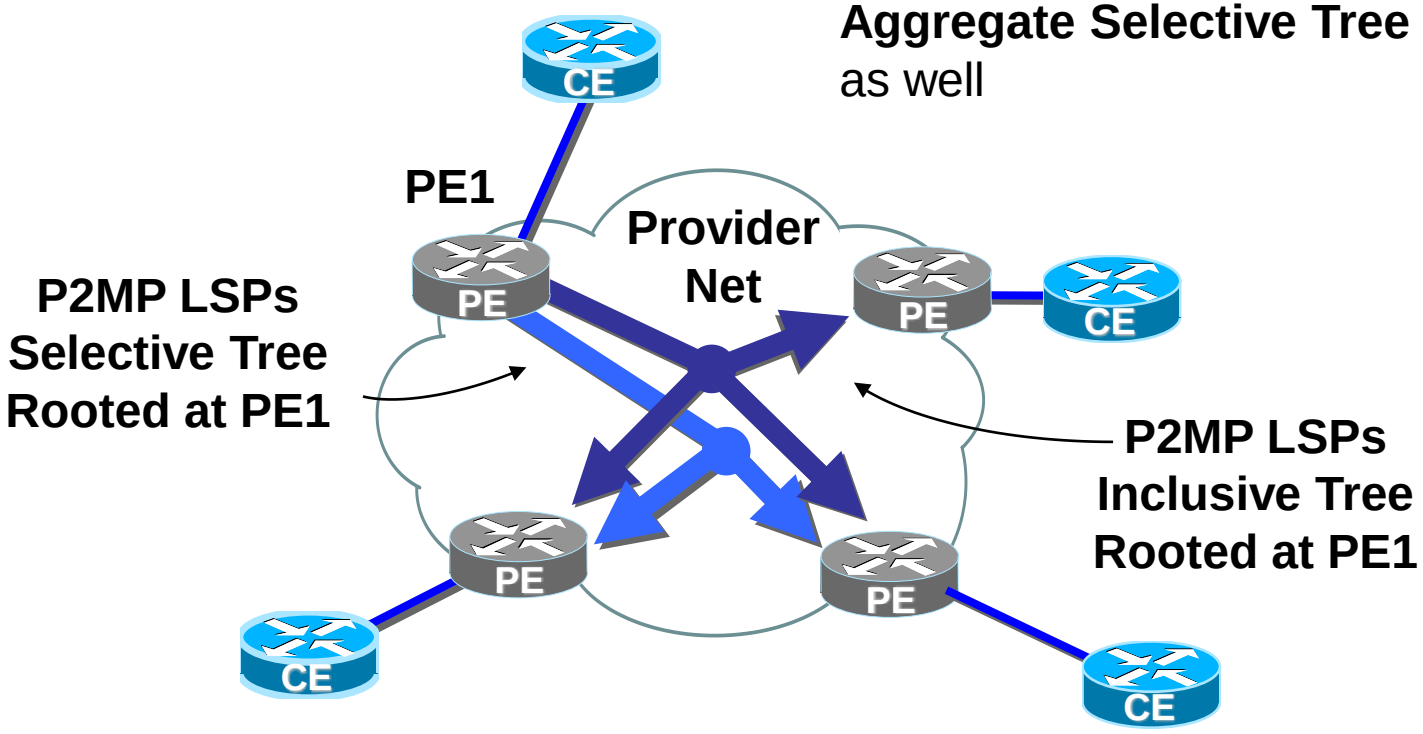
Provider Tree (P-Tree) types
Aggregate Inclusive Tree

All the multicast groups in more than one MVPN use the same shared tree!



Provider Tree (P-Tree) types
Selective Tree

Selective Tree - analogous to Data-MDT in draft-Rosen
Serves particular selected multicast group(s) from a given MVPN with Active Receivers
Aggregate Selective Tree is possible as well



Control Plane Functions

- **mVPN Membership Autodiscovery** - Discovery of which PEs are members of each MVPN and communication between PEs (NextGen VPN Alternatives are PIM based or BGP based – preferred one)

- **mVPN to Tunnel Mapping** - A PE router needs to know what type of tunnel and identifier to use for sending (and receiving) multicast data for a particular MVPN.

- **PE-PE C-multicast Route Exchange** - A PE router participates in the customer multicast (C-multicast) routing protocol by forming multicast routing adjacencies over its VPN interface.

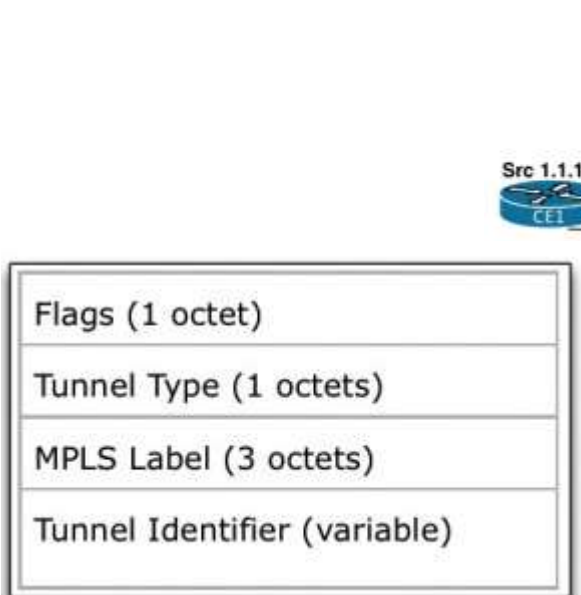
BGP MCAST-VPN Address Family

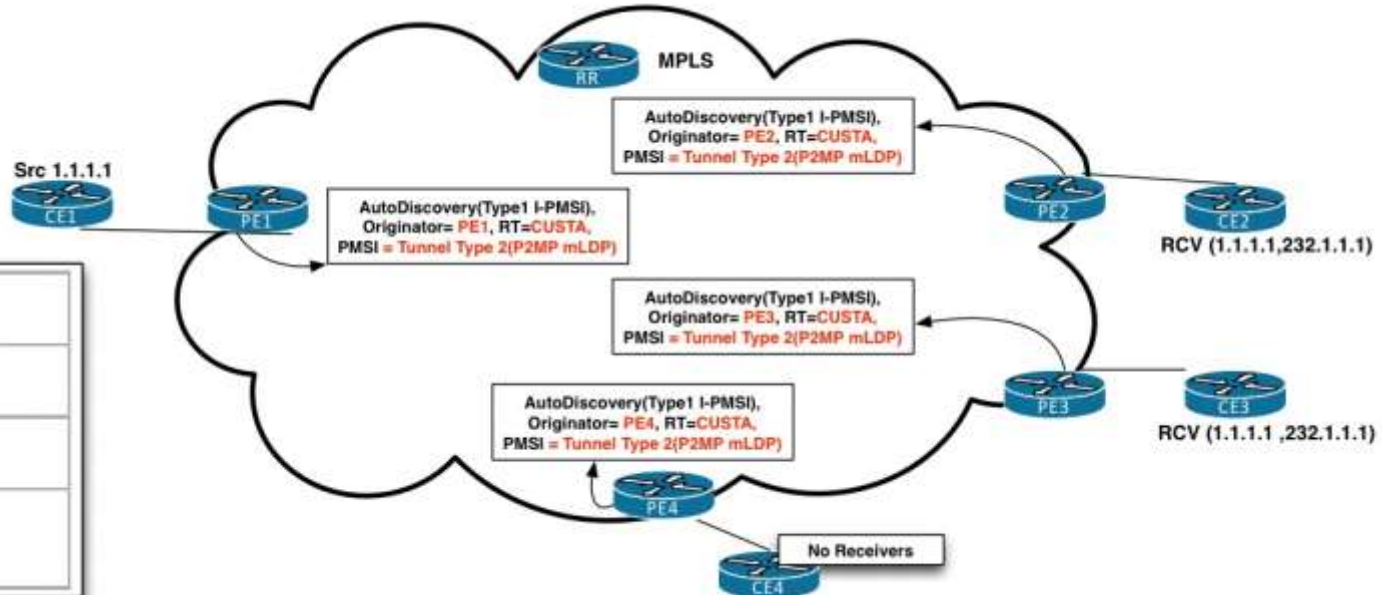
- The new BGP address family (SAFI 5) is called MCAST-VPN and used for distributing MVPN control (signaling messages) information between PE routers – so called "**mvpn routes**"
- There are seven types of mvpn routes:
  - Type 1 - Intra-AS auto-discovery route (A-D route)
  - Type 2 - Inter-AS auto-discovery route (inter-AS A-D route)
  - Type 3 - S-PMSI (Selective P-Multicast Service Interface) A-D route
  - Type 4 - Intra-as leaf A-D route
  - Type 5 - Source Active A-D route (or SA route)
  - Type 6 – Shared Tree Join Route (C-multicast route)
  - Type 7 – Source Tree Join Route (C-multicast route)

- The first 5 mvpn routes can be considered as the auto-discovery routes while last two are used for C-multicast routing exchange between PE routers of an MVPN.

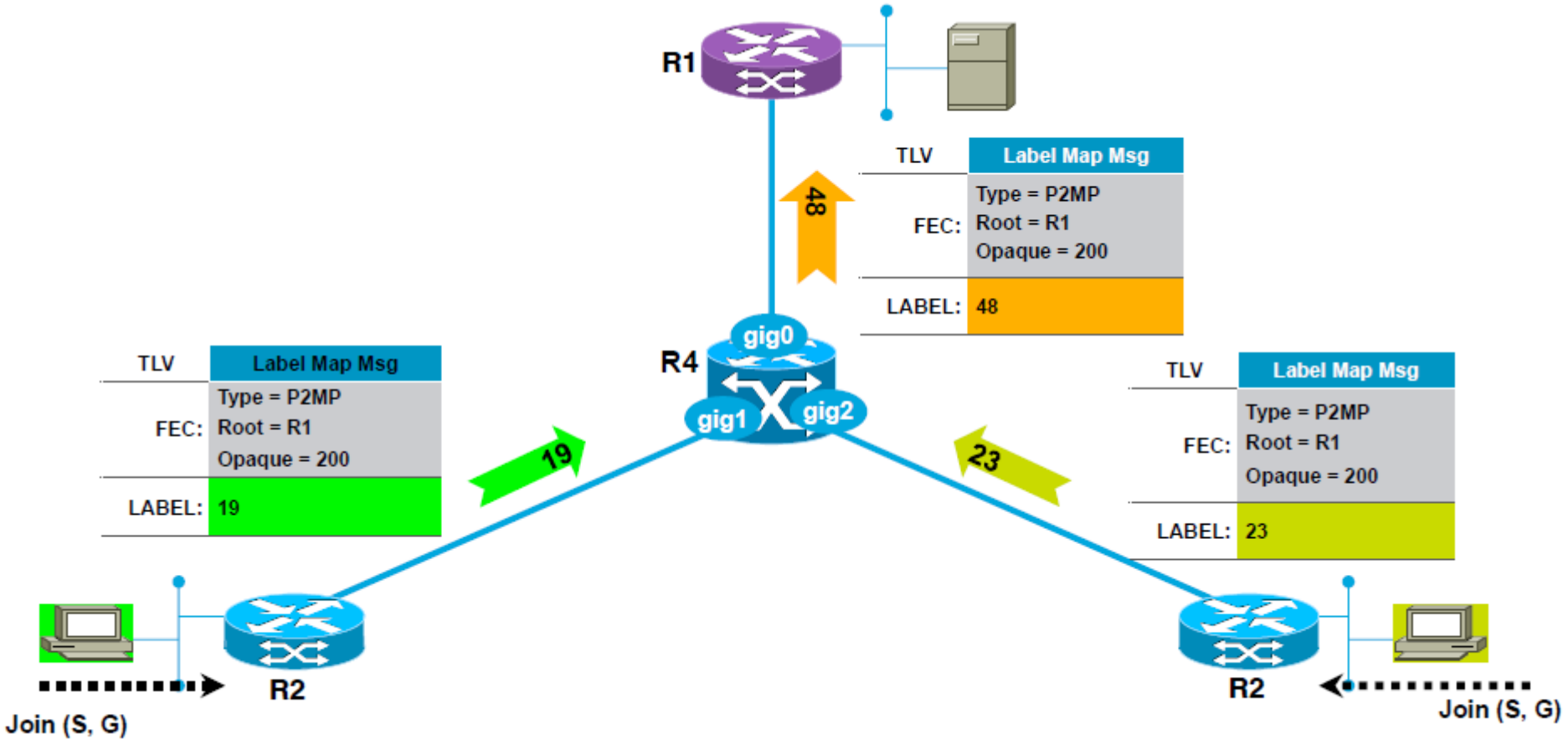
NG-MVPN Implementation

- iBGP
  - PE1/PE2/PE3 IBGP sessions are established with INET-VPN and MCAST-VPN NLRIs
- INET-VPN NLRI
  - PE1 advertises VPN-IP unicast routes with RT and RD (including route to Cust-Source) to PE2/PE3 via Inet-VPN NLRI
  - All PEs originate&advertise a Type 1 AD routes (typically a loopback). PE1 also attaches a PMSI attribute to the AD route based on P-tunnel configuration (Tunnel Type and Tunnel Identifier), confirmed by receivers using Type 4
  - PE routers join through the tunnel identified in the PMSI attribute



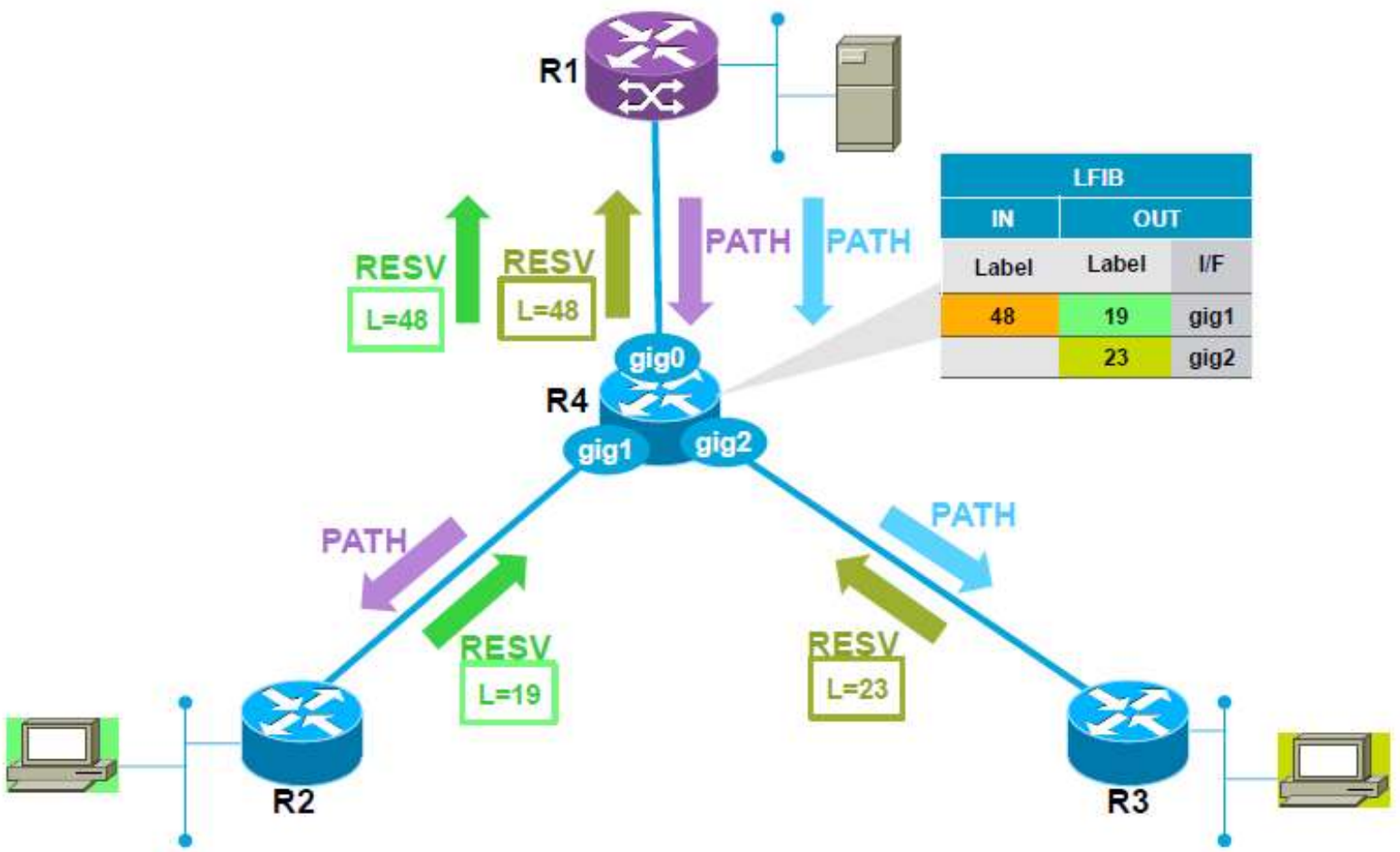


P2MP mLDP Tree setup



Opaque value - also called Tunnel/Tree Identifier

P2MP RSVP-TE Tree setup



NG-mVPN Implementation

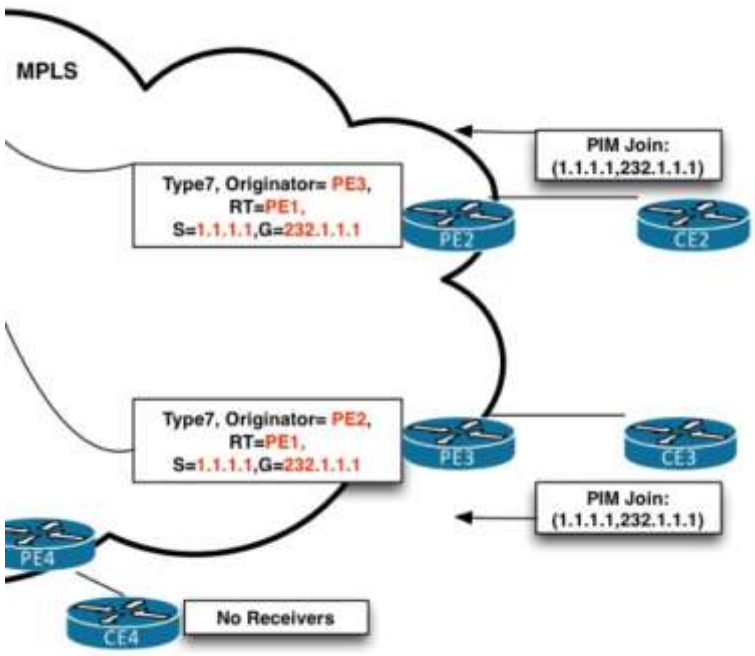
Receiver side receives a (C-*, C-G) Join

- Receivers come online - PEs receive (C-*,C-G) from CEs
- PEs does a route lookup in the VRF unicast table for C-RP and constructs Type 6 Shared Tree C-multicast route

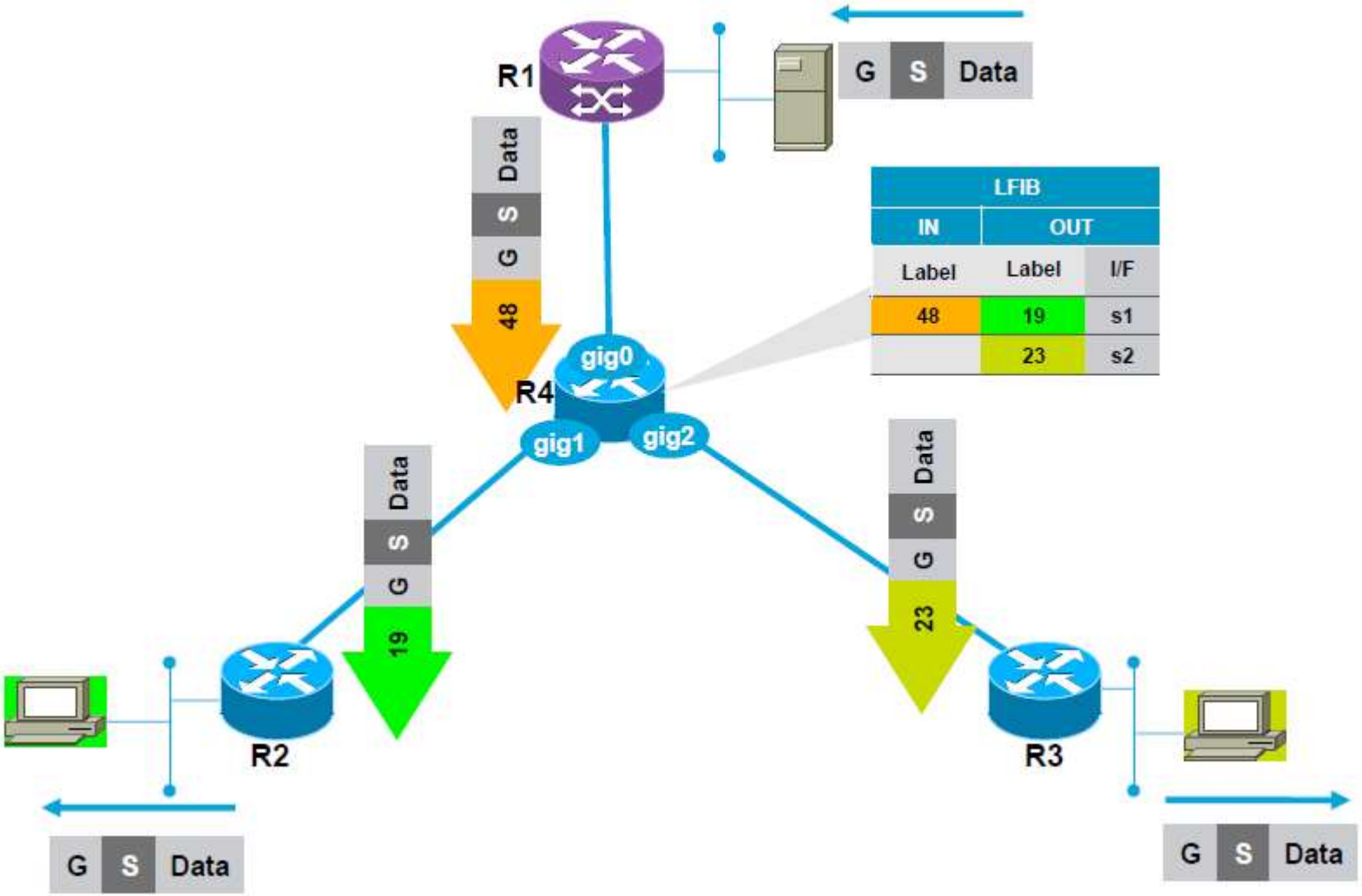
- C-Multicast Data
  - Meanwhile Source becomes active PE1 receives data for (C-*,C-G) from CE1 and sends to shared tree, all PEs receive it

Receiver side receives a (C-S, C-G) Join

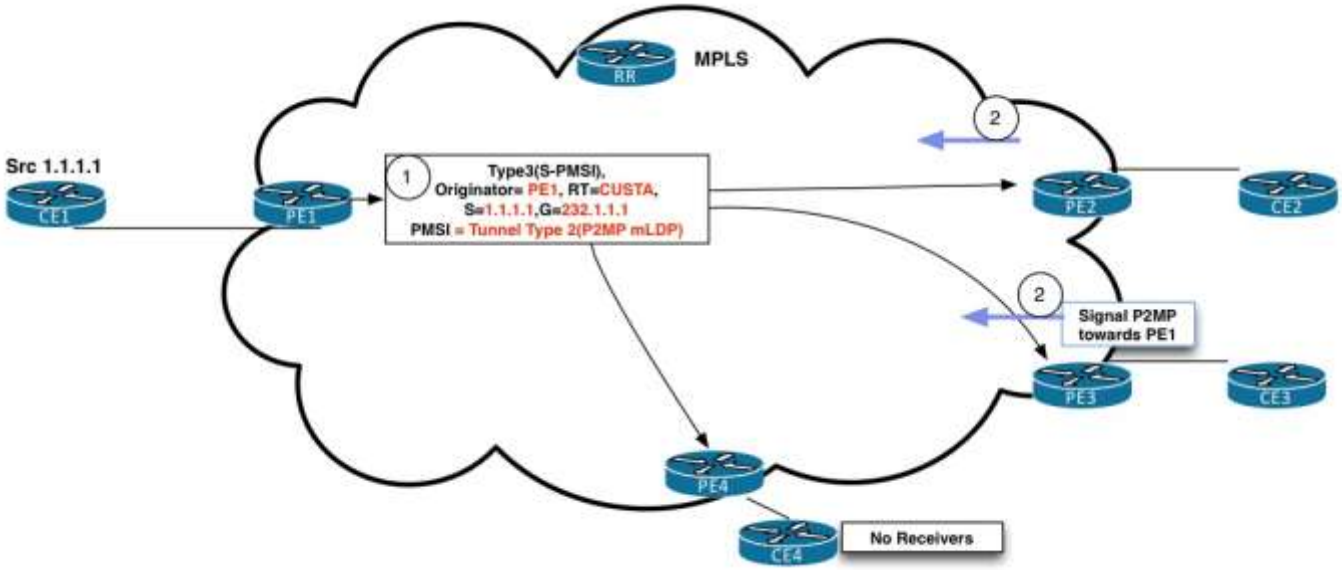
- PE1 (C-RP) originates a Type 5 SA AD (source active) route and advertises it to PEs
  - PEs originate and advertise a Type 7 (source tree) source C-multicast route to PE1 (PE1 accepts based on unique RT – Hub&Spoke like)
  - the source C-multicast route is accepted and (C-S,C-G) is passed to C-multicast protocol on PE1/VPNA to be processed
  - PE1 creates state in C-PIM database and propagates (C-S, C-G) to CE1 towards the source

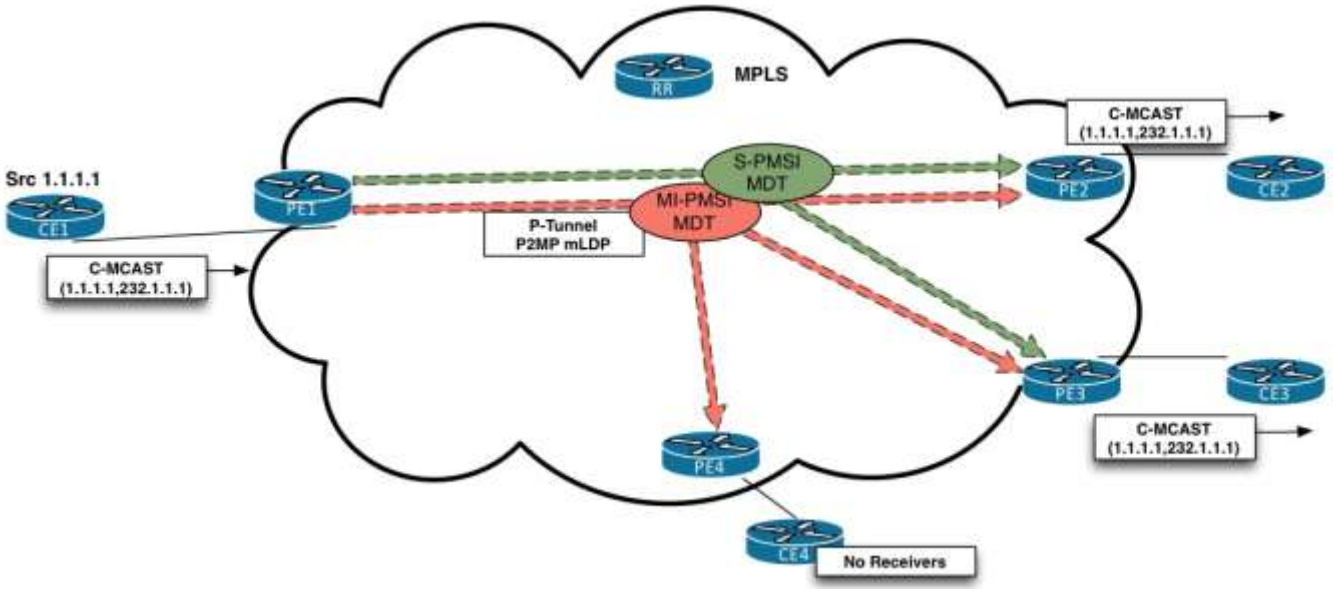


Data Forwarding

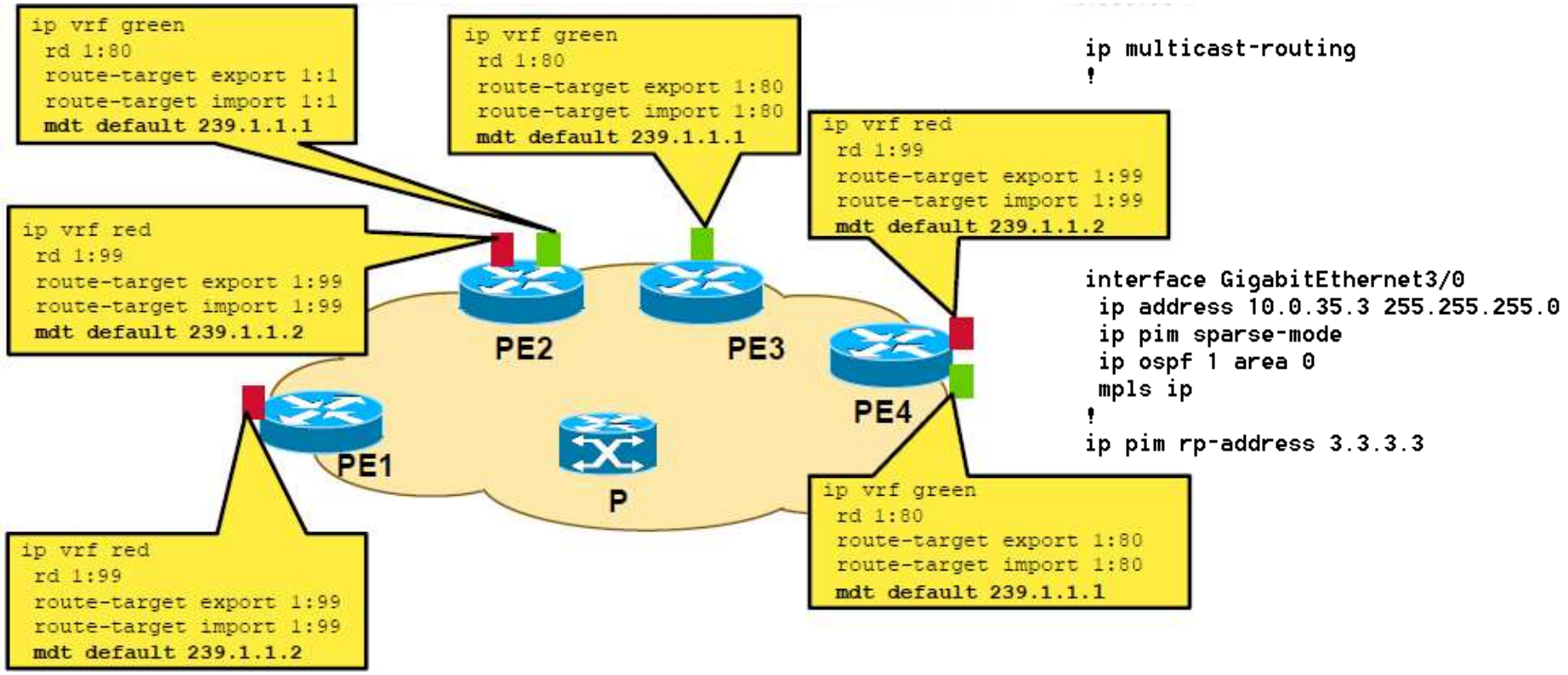


Selective P-Tree





Cisco Draft Rosen Implementation with BGP AD



Default-MDT has two components

- Group address which is configurable and source address – typically loopback used by MP-iBGP

PE routers tell other routers that they participate in an mVPN. This triggers the setup of the default-MDT. New mVPNv4 family

Multicast Tunnel and mVRF setup

Tunnel setup

- PIM enabled in the core on all backbone interfaces
- MDT group address configured
- MP-iBGP session established
- PE will join the root of the tree with the group address configured in the vrf (IP address of RP part of MVPN-IPv4 update)

```
!
ip pim rp-address 3.3.3.3
```

Multicast VRF

- MVRF is created when multicast routing is enabled for that VRF

```
ip multicast-routing
ip multicast-routing vrf A
```

- Multicast protocols like IGMP and PIM are configured and operate in the context of an MVRF

```
interface FastEthernet2/0
 vrf forwarding A
 ip address 10.0.12.2 255.255.255.0
 ip pim sparse-mode
 ip ospf 2 area 0
!
```

- mVRF only contains the multicast routing information for the VRFs that make up a multicast domain

```
R2#sh ip pim vrf A neighbor
```

Ďakujem za pozornosť

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