

BGP Extensions for Service-Oriented MPLS Path Programming (MPP)

draft-li-idr-mpls-path-programming-02

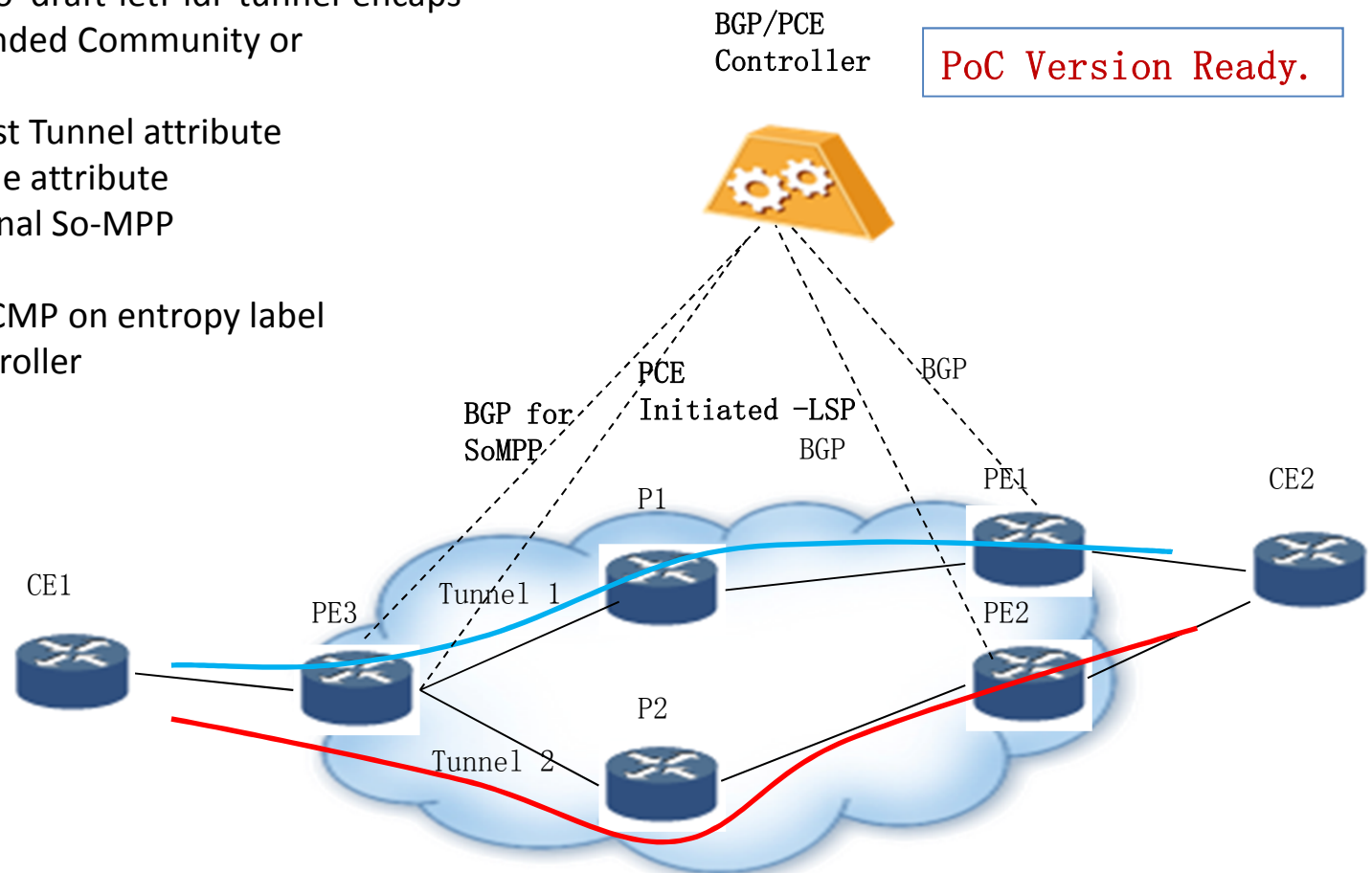
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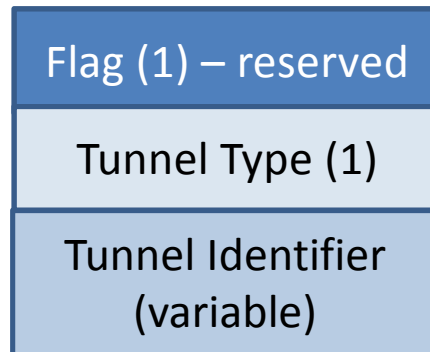
Service Oriented Segment Path Programming (SO-MPP)

- **SO-MPP - MPLS path for specific service flows**
 - Flexible label mapping to indicate service flows
 - Flow identified by 5 tuple of IP header
 - Flow mapped to MPLS Tunnel
- **BGP extensions**
 - Extended Label Attributes: Label Stack for NLRIs
 - 4 tunnel types to draft-ietf-idr-tunnel-encaps
 - Route Flag Extended Community or Cost Community
 - Extended Unicast Tunnel attribute
 - Destination Node attribute
 - Capability to signal So-MPP
- **Use Case:**
 - Deterministic ECMP on entropy label
 - Centralized controller



BGP Extensions (1)

- 4 tunnel types
 - LDP LSP,
 - RSVP-TE LSP
 - MPLS segment routing Best Effort,
 - MPLS-based Segment routing Traffic Engineering
- Extended Unicast Tunnel Attribute
 - optional transitive

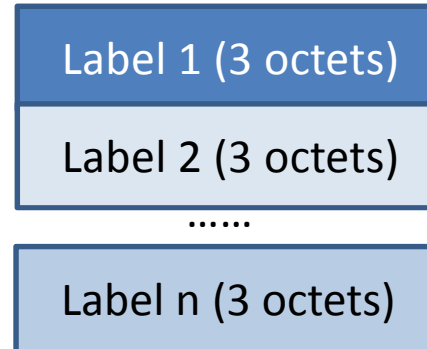


Tunnel type:
0: none (*0)
ingress
1: RSVP-TE LSP (*1)
2: MPLS segment routing TE (*1)

*0 – ingress router set path

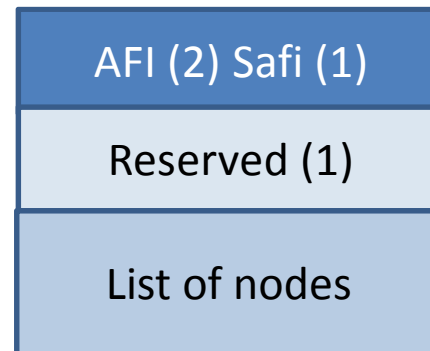
*1 = <C-Type, Tunnel Sender Address, Tunnel ID, Tunnel End-point Address>

- Extended Label Attributes



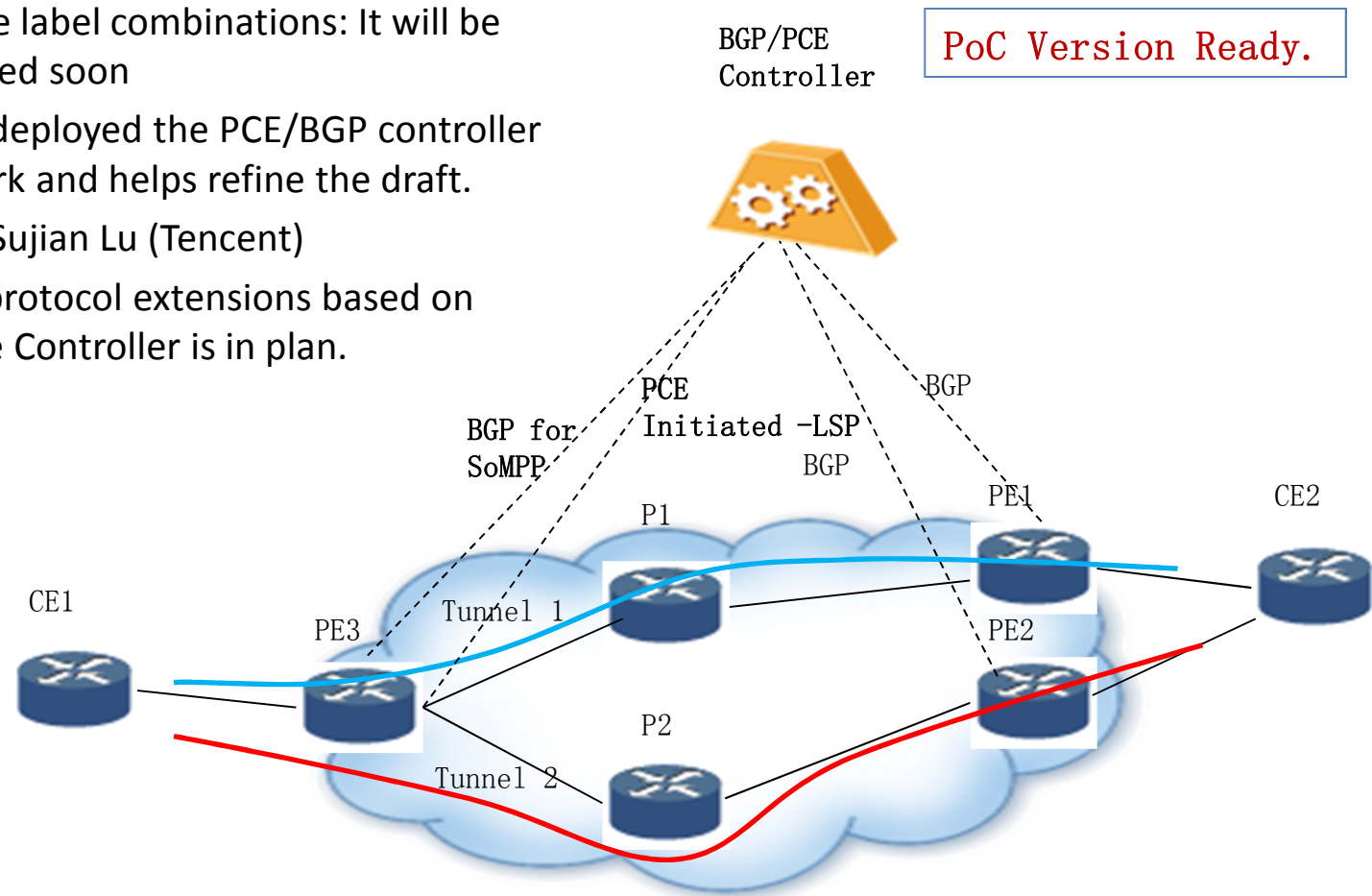
BGP Extensions (2)

- Route Flags as Best Route
 - Cost community Extended to have point insertion = 128
 - Route flag community or extended community
- Destination Node attribute – optional non-transitive



Prototypes and Open Source

- Prototypes:
 - Flexibly map services to tunnels: It has been implemented.
 - Flexible label combinations: It will be delivered soon
- Tencent has deployed the PCE/BGP controller in the network and helps refine the draft.
Co-author (Sujian Lu (Tencent))
- Delivery of protocol extensions based on Open Source Controller is in plan.



Link to Flowspec

- BGP Flowspec “Redirect to tunnel”
 - Adds tunnel types for flow
 - Utilizes draft-hao-idr-flowspec-redirect-tunnel
- BGP Path
 - draft-vandeveldde-idr-flowspec-path-redirect-00
 - Path ID may specify specific tunnel.
 - Extended Unicast Tunnel may do the same thing

Next Step

- The work is practical and becoming mature now. After the refinement, the draft is also consolidated.
- Call for WG adoption.

DETAILS ON DRAFT

SPP and SoMPP

- Segment Path Programming (SPP)
 - Concept:
 - Flexible Segment Combination
 - Flexible Mapping of Service to Segment Path
 - draft-li-spring-mpls-segment-path-programming
 - Segment and Segment Path are generalized more than Segment Routing.
- Service-oriented MPLS Path Programming (SoMPP)
 - Concept: Programming MPLS path for specific service flow
 - Flexible label combination should be applied to the flow to indicate a series of service process.
 - Flexibly map the flow to tunnels with different constraints/attributes.
 - The flow can be specified by the prefix or “5-tuple” of IP header. BGP is the appropriate protocol.

Architecture and Usecases for SoMPP

- Architecture
 - Central Control for whole network & portions of network
- Usecases
 - Deterministic ECMP based on Entropy label/Flow label:
 - calculated centrally against the global view of traffic pattern
 - Centralized Mapping of Service to Tunnels:
 - PCE-initiated LSP are adopted to set up tunnels centrally with different constraints.
 - BGP extensions map the flow to the tunnel based on service requirements.

BGP Extensions for SoMPP

1. Capability Negotiation
2. Download of MPLS Path
 - Extended Label Attribute: Apply multiple labels to specific BGP prefix of multiple BGP AFI/SAFI.
3. Download of Mapping of Service Path to Transport Path
 - Specify Tunnel Type for the flow specified by BGP prefix:
 - Specify Specific Tunnel for the flow specified by BGP prefix
 - Extended Unicast Tunnel attribute is introduced to specify the tunnel identifier of RSVP-TE LSP and Segment Routing-TE path.
4. Best Route Selection:
 - Option 1: One new Extended Community, Route Flag Extended Community, is introduced.
 - Option 2: Reuse the Cost Community defined by [I-D.ietf-idr-custom-decision].
5. Specify receivers of the routes advertised by controller
 - Destination Node Attribute: a list of receiving node addresses can be defined.

Updates Since IETF 93

- Add one co-author: Sujian Lu (Tencent)
 - Tencent has deployed the PCE/BGP controller in the network and helps refine the draft.
- Add the option 2 for “Best route selection” besides introducing new Extended Community, Route Flag Extended Community.
- Procedures of load balance with multiple unicast tunnels are defined explicitly.

- Remove the early ideas of MPLS service label/segment allocation based on BGP extensions.
 - draft-wu-idr-segment-allocation will explore the possible solutions.
- Remove the “Extended Multicast Tunnel Attributes”
 - Since tunnel attributes of the existing BGP-based multicast service such as MVPN/VPLS multicast/EVPN can be reused.
 - Re-defined when it is applied in the central control environment in the future.

Relationship with BGP Flowspec (1)

- Relationship with BGP Flowspec “Redirect to tunnel”
 - Specify the tunnel type: [I-D.ietf-idr-tunnel-encaps] is necessary. draft-li-idr-mpls-path-programming extends [I-D.ietf-idr-tunnel-encaps] to define more tunnel types.
 - Specify the tunnel identifier:
 - Until now only RSVP-TE LSP and SR-TE Path define the tunnel identifier. draft-li-idr-mpls-path-programming defines them for the “Extended Unicast Tunnel Attributes”.
 - draft-chen-pce-pce-initiated-ip-tunnel is to introduce the tunnel identifier for IP tunnels which is composed by tunnel type, source address, destination address and tunnel ID. Maybe later more Tunnel Identifiers will be defined for the “Extended Unicast Tunnel Attributes”.
 - MPLS Tunnel Types and Extended Unicast Tunnel Attributes can be applied to more BGP AFI/SAFI than BGP Flowspec.
- Remaining Issues:
 - Specify the attributes of MPLS TE tunnels:
 - [I-D.ietf-idr-tunnel-encaps] can specify the tunnel attributes. There are rich TE attributes for RSVP-TE LSP. Can it be defined in BGP extensions?
 - Same work has ever been done. But it is dropped.
 - Tunnel attributes defined by RFC 6514 does not take it into account for P2MP MPLS TE tunnel.

Relationship with BGP Flowspec (2)

- Relationship with BGP Flowspec “Redirect to Path ID”
 - Path ID may specify specific tunnel.
 - Semantics Independent: may specify the link, netxhop, tunnel.
 - The path ID should be explained locally and not defined yet.
 - Extended Unicast Tunnel Attributes can also specify specific tunnel.
 - Semantics Dependent: Only specify tunnels.
 - Tunnel identifier has global meaning which can be understood by other nodes more than the endpoints of the tunnels. It has been defined by RFC3209.
 - Different methods for BGP Flowspec to implement “redirect to tunnel”.

Additional Points from Segment Path Programming (1)

- draft-li-spring-segment-path-programming generalizes more use cases based on segment and proposes the concept of Segment Path Programming.
- Segment ID can be an indicator which are only used in the control plane other than combining with MPLS forwarding plane and IPv6 forwarding plane for segment routing.
- Segment ID can be an local/global indicator to be seen outside for the purpose of traffic steering. It can represent the link, the node, the forwarding agency, the tunnel, etc.
- Please refer to “5. Usecases of Segment Path Programming” of draft-li-spring-segment-path-programming
 - 5.3. Steering Traffic without Mapping Segment to Label
 - 5.4. Centralized Mapping Service to Tunnels

Additional Points from Segment Path Programming (2)

- The draft of “BGP Flowspec of Redirect to Segment ID” is in process to satisfy the protocol extensions requirements of draft-li-spring-segment-path-programming:
 - Segment (Stack) Identifier Attributes can be defined to indicate the entities which the traffic will be steered to. The attributes can be applied to multiple BGP AFI/SAFI.
 - One new extended community, “Redirect to Segment ID”, can be defined for BGP Flowspec.
- If the work can be done, it may propose the alternative solutions for “redirect to interface group” or “redirect to path ID”.
 - Segment ID can be the alternative way of Path ID proposed by the draft “BGP Flowspec Redirect to Path ID”. Then it may save the work to define the Path ID from the beginning. But there is some difference between Segment ID and Path ID. For Path ID, it is totally “semantics independent” while the segment type should be specified for Segment ID which will introduce something “semantics dependent”.
 - Multiple Segment IDs which are a group of indicators of link segments of a specific node can be carried with BGP Prefix which can redirect the flow to the specified interface group specified by multiple segment IDs.

Additional Points from Segment Path Programming (3)

- How to process the overlapped the solutions for the similar requirements:
 - Keep the existing method of BGP Flowspec to define the “semantics dependent” entity such as VRF, Remote IP, Tunnel, etc. ?
 - The methods to define “semantics independent” entity such as Path ID, Segment ID, Interface Group ID, etc should be consolidated. ?