

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

draft-li-idr-mpls-path-programming-00

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Introduction

- Service-oriented MPLS programming proposed by [I-D.li-spring-mpls-path-programming] is to provide customized service process based on flexible label combinations.
- BGP will play an important role for MPLS path programming to allocate MPLS segment, download programmed MPLS path and the mapping of the service path to the transport path.
- This document defines BGP extensions to support service-oriented MPLS path programming.

Use Cases for Unicast Service MPLS Path Programming

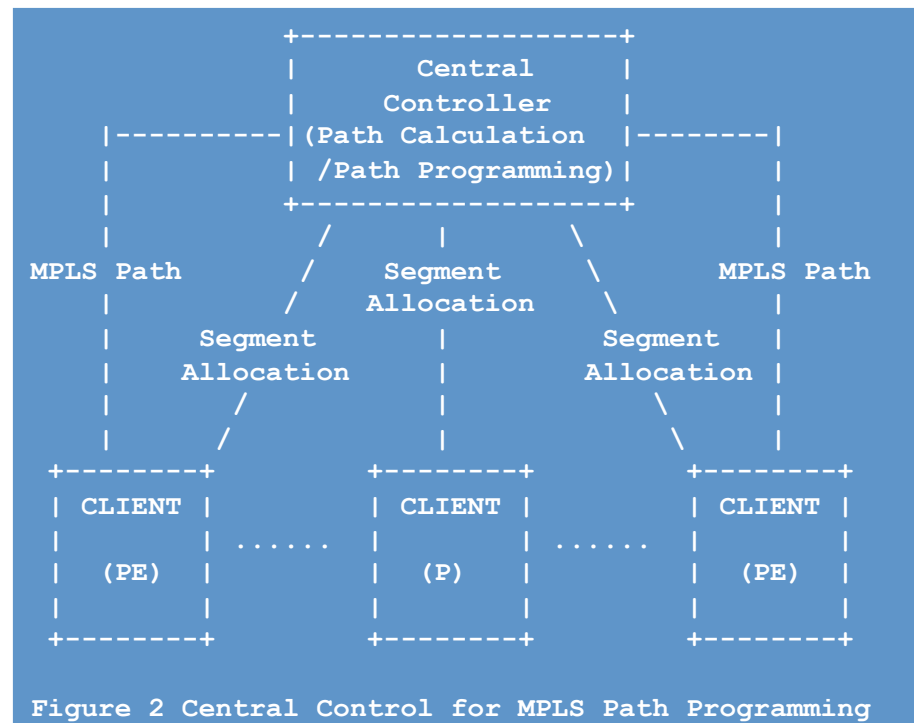
- Use cases for unicast service MPLS path programming is shown as follows:

Entropy	Steering	VPN Prefix	VPN	Source	--->	Transport
Label	Label	Label	Label	Label		Tunnel

- ✓ **VPN Prefix Label** : Basic reachability. It is defined in [RFC4364].
- ✓ **VPN Label**: Identification of VPN. It is defined in [I-D.zhang-l3vpn-label-sharing].
- ✓ **Entropy Label**: Identification of ECMP. It is defined in [RFC6790].
- ✓ **Source Label**: Identification of source PE which can be used for OAM. It is defined in [I-D.chen-mpls-source-label].
- ✓ **Steering Label**: [I-D.filsfils-spring-segment-routing-central-epe] illustrates the application of steering label for the Egress Peer Engineering (EPE).

Architecture of MPLS Path Programming

- Central control plays an important role in MPLS path programming. It can extend the MPLS path programming capability easily. There are two important functionalities for the central control:
 - Central controlled MPLS label allocation: Label can be allocated centrally for special usage other than reachability. These labels can be used to compose MPLS path. We call it as MPLS Segment.
 - Central controlled MPLS path programming: Central controller can calculate path in a global network view and implement the MPLS path programming based on the collected information of MPLS segments to satisfy different requirements of services.

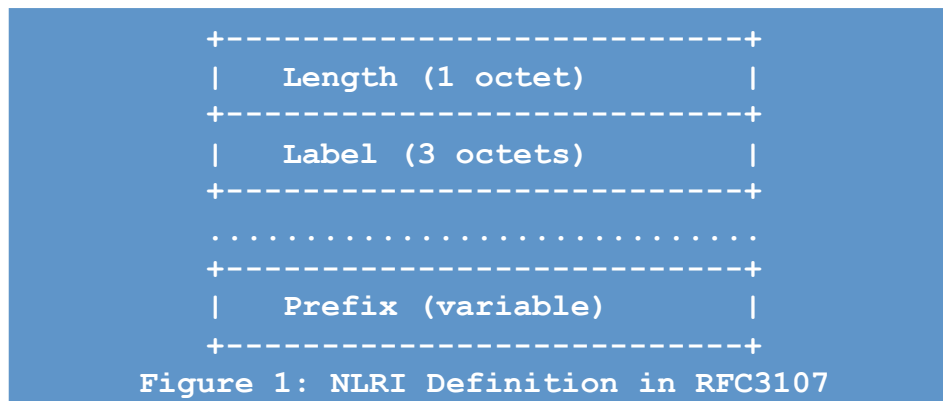


BGP Extensions Requirements for Service-Oriented MPLS Path Programming

- **BGP**
 1. REQ 01: BGP extensions SHOULD be introduced to distribute local label mapping for specific process.
 2. REQ 02: BGP extensions SHOULD be introduced to distribute global label mapping for specific process.
 3. REQ 03: BGP extensions SHOULD be introduced to download label stack for service-oriented MPLS path.
 4. REQ 04: BGP extensions SHOULD be introduced to carry the identifier of the transport MPLS path with service MPLS path to implement the mapping.

Download of MPLS Path

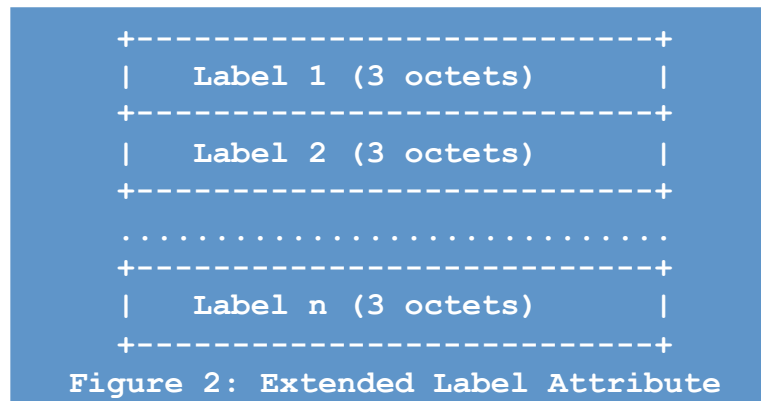
- According to the service requirements, the central controller can combine MPLS segments flexibly. Then it can download the service label combination for specific prefix related with the service. BGP extensions are necessary to advertise label stacks for prefix in NLRI field.



- [RFC3107] defines above NLRI to advertise label binding for specific prefix. The label field can carry one or more labels.
- But for other AFI/SAFIs using label binding such as VPNv4, VPNv6, EVPN, MVPN, etc., it dose not support the capability to carry more labels for the specific prefix.
- Moreover for the AFI/SAFIs which do not support label binding capability originally, but may possibly adopt MPLS path programming now, there is no label field in the NLRI.

Download of MPLS Path (Cont.)

- In order to support flexible MPLS path programming, this document defines and uses a new BGP attribute called the "Extended Label attribute".



- The Label field carries **one or more labels** (that corresponds to the stack of labels [[RFC3032]]).
- The Central Controller for MPLS path programming could build a route with **Extended Label attribute** and send it to the ingress routers.

Download of MPLS Path (Cont.)

- Upon receiving such a route from the MPP Controller, the ingress router SHOULD select such a route as the best path.
- If a packet comes into the ingress router and uses such a path, the ingress router will encapsulate the stack of labels which gets from the Extended Label Attribute of the route into the packet and forward the packet along the path.
- The "**Extended Label attribute**" can be used for various BGP address families.
- Before using this attribute, firstly, it is necessary to negotiate the capability between two nodes to support MPLS path programming for a specific BGP address family.

Download of Mapping of Service Path to Transport Path

- Since the transport path is also to satisfy the service bearing the requirement, it can also be programmed according to traffic engineering requirements of service. Or the transport path can be set up according to general traffic engineering requirements. Then there **needs to be implements the mapping of the service path to the transport path.**
- [RFC6514] defines the "P-Multicast Service Interface Tunnel (PMSI Tunnel) attribute". The attribute can not be applied to all possible use cases of service-oriented MPLS path programming.
- This document accordingly defines two new types of BGP attribute for both usage of unicast service path and the multicast service path:
 - ✓ Extended Unicast Tunnel Attribute
 - ✓ Extended PMSI Tunnel Attribute

Extended Unicast Tunnel Attribute

- This document defines and uses a new BGP attribute called the "Extended Unicast Tunnel attribute".

```
+-----+
| Flags (1 octet) |
+-----+
| Tunnel Type (1 octets) |
+-----+
| Tunnel Identifier (variable) |
+-----+
| Tunnel Specific Attributes (Variable) (Optional) |
+-----+
```

- The Tunnel Type identifies the type of the tunneling technology used for the unicast service path. The type determines the syntax and semantics of the Tunnel Identifier field. This document defines the following Tunnel Types:
 - + 0 - No tunnel information present
 - + 1 - RSVP-TE LSP
 - + 2 - LDP LSP
 - + 3 - GRE Tunnel
 - + 4 - MPLS-based Segment Routing Best-effort Path
 - + 5 - MPLS-based Segment Routing Traffic Engineering Path

Extended PMSI Tunnel Attribute

- This document defines and uses a new BGP attribute called the "Extended PMSI Tunnel attribute".

```
+-----+
| Flags (1 octet) |
+-----+
| Tunnel Type (1 octets) |
+-----+
| Tunnel Identifier (variable) |
+-----+
| Tunnel Specific Attributes (Variable) (Optional) |
+-----+
```

- The Tunnel Type identifies the type of the tunneling technology used for the multicast service path. The type determines the syntax and semantics of the Tunnel Identifier field. This document defines the following Tunnel Types:
 - + 0 - No tunnel information present
 - + 1 - RSVP-TE P2MP LSP
 - + 2 - mLDP P2MP LSP
 - + 3 - PIM-SSM Tree
 - + 4 - PIM-SM Tree
 - + 5 - BIDIR-PIM Tree
 - + 6 - Ingress Replication
 - + 7 - mLDP MP2MP LSP

Next Step

- Seek comments and feedbacks
- Revise the draft