MPLS Segment Routing in IP Networks

draft-bryant-mpls-unified-ip-sr

Stewart Bryant <stewart.bryant@gmail.com>
Adrian Farrel <afarrel@juniper.net>
John Drake <jdrake@juniper.net>
Jeff Tantsura <jefftant.ietf@gmail.com>

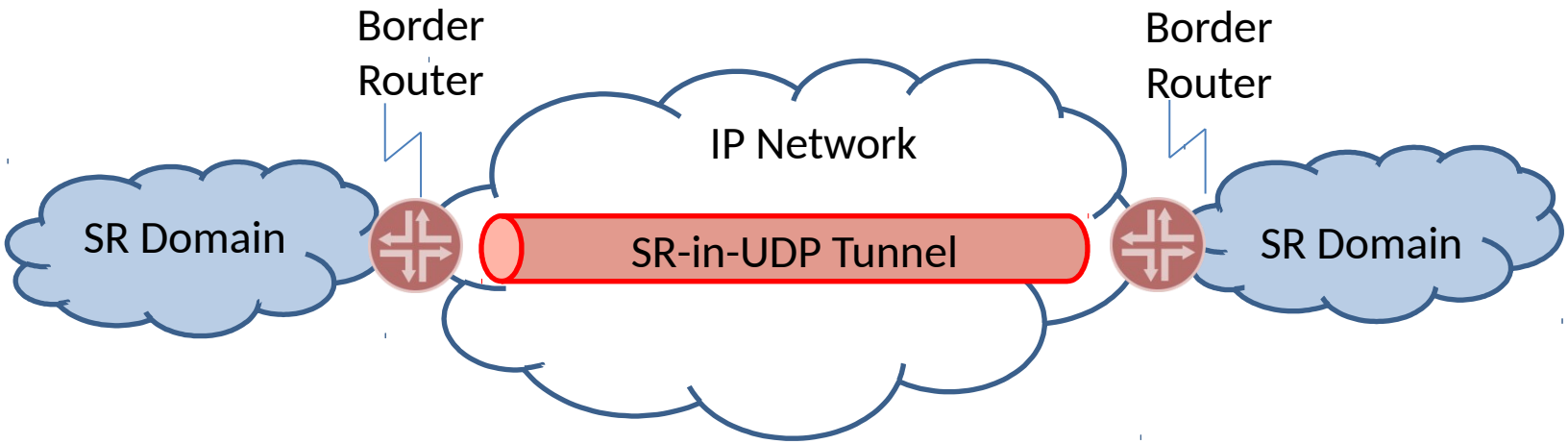
IETF-100, Singapore, November 2017

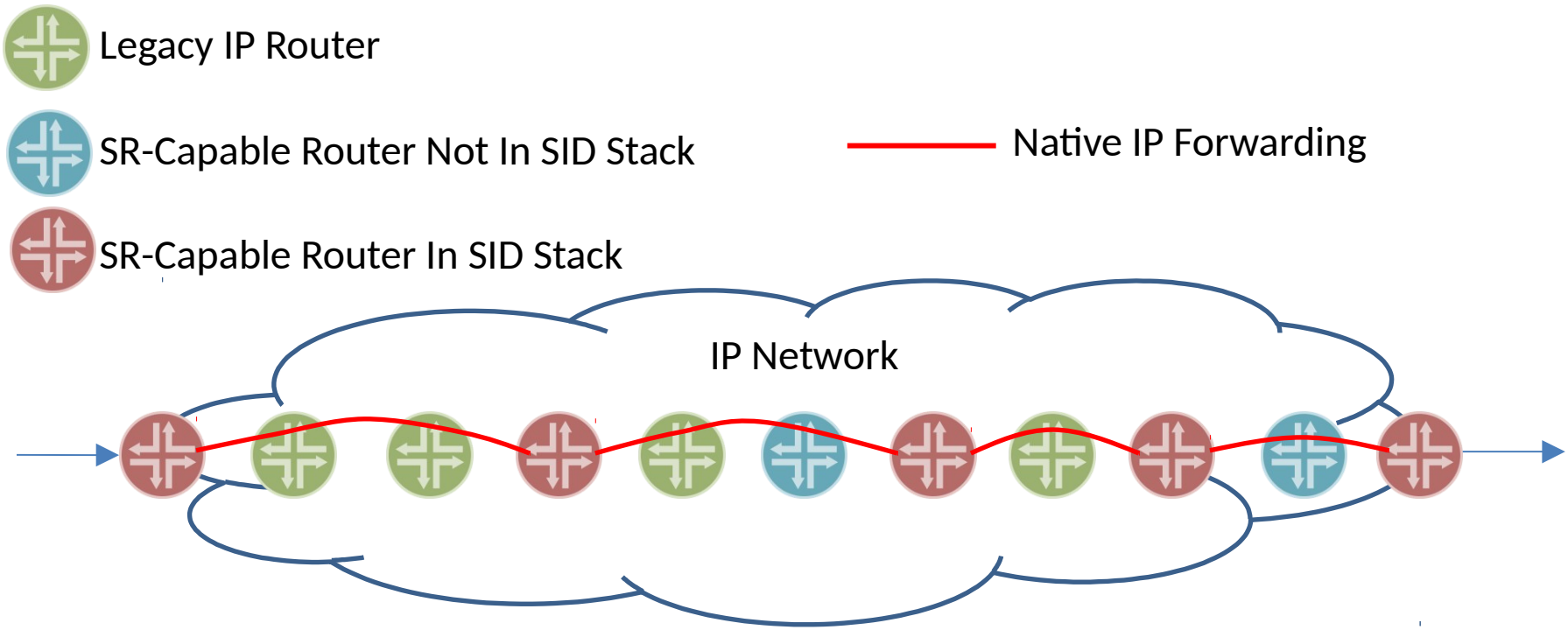
Objective

Objectives

1. Tunnel MPLS-SR over an IP network
   - To connect two MPLS-SR networks (e.g., data centres)
2. Enable SR in legacy networks by tactically introducing SR-capable nodes at strategic points in the network.
3. It is not a specific objective, but the approach is IPv4/v6 neutral.

Use Cases

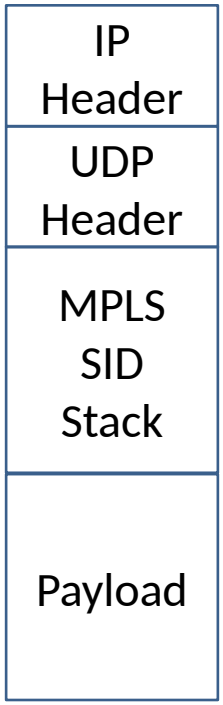

Border
Router
Border
Router
IP Network
SR Domain
SR-in-UDP Tunnel
SR Domain


Legacy IP Router
SR-Capable Router Not In SID Stack
SR-Capable Router In SID Stack
Native IP Forwarding
IP Network

Technical Summary

Overview

- In summary, this is MPLS-over-UDP as RFC 7510

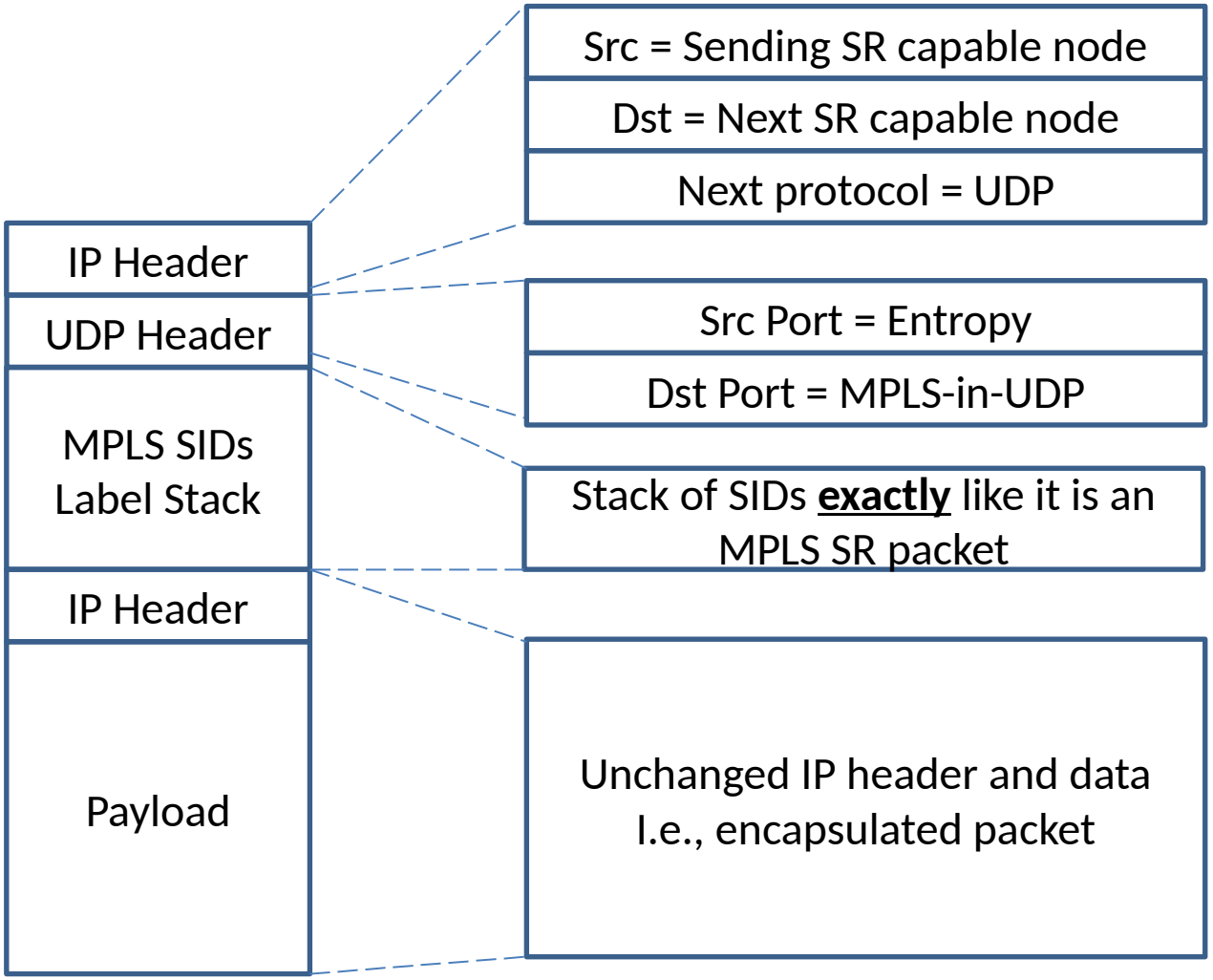


- Encapsulate a “normal” MPLS SID stack in UDP in IP
- Address to next SR-capable node in the SR path
- UDP destination port indicates “MPLS below”

MPLS-SR-in-UDP Processing

- IGP and control plane just like MPLS-SR
- Source processing is just like MPLS-SR
  - But encapsulate in UDP and IP to first router identified by first SID
- Legacy transit nodes
  - It is just an IP packet, so simply forward it
- SR-capable transit nodes
  - Process MPLS-SID stack as normal
  - Encapsulate in UDP and IP and send to router identified by next SID
- Final hop just strips outer header and forwards payload packet

A Little More Detail



Advertising SIDs

- Advertisements are just like for MPLS SR
  - IGP or BGP advertises
    - Address of node or link
    - Associated SID
  - All SID types are supported
- Need to add advertisements in routing protocol to specify
  - Encapsulation Type
  - PHP behaviour

Source Processing

- Build and impose MPLS-SR stack
- Encapsulate in UDP
  - Dst Port = MPLS-in-UDP
  - Src Port = Entropy
- Encapsulate in IP with
  - Source as this node
  - Destination address of first hop in SR stack
    - Requires look-up to match SID to address
    - At source, this lookup can use RIB, etc.
- FIB lookup and send
- (This all looks a lot like RFC 7510)

Transit Non-SR Processing

- Important that this mechanism can traverse nodes that are not SR-capable
  - Also, no special processing by SR nodes to which the packet is not addressed
- It's just an IP packet, so forward it
- ECMP entropy is achieved through the UDP source port value set by source
  - Established technique (RFC 7510)
- TTL decrements as usual

Transit SR Processing

- If the packet is addressed to me
  - Otherwise just forward the packet as normal IP
- Find UDP inside
- Find UDP Dst port is “MPLS-in-UDP”
- Look at top of MPLS SR stack
  - Extract SID and look up “next hop” IP address
  - Pop label stack entry
- Re-encapsulate packet as MPLS-in-UDP-in-IP (just as source did)
  - IP Src = this node
  - IP Dst = next address as found from label lookup
  - UDP Src Port = Entropy (ideally from received packet)
  - UDP Dst Port = MPLS-in-UDP
  - (SID stack is “shorter”)
- FIB lookup and send

Key Changes from -00

- Forwarding clarifications
  - Transit node elements of procedure.
  - Entropy handling.
  - PHP processing described in detail.
  - Clarification of egress processing.
  - Processing of an erroneously received packet described.
- Control Plane
  - A summary of the existing control planes and extension required to support PHP is provided.

Moving Forward

Additional Encapsulation Technologies

- This draft describes the use of UDP as the encapsulation.
- There may be a need for other encapsulations (VXLAN, GRE, IPSEC etc.)
- If there is such a need, the right approach is to write up a data-plane specific solution for each of these cases in separate RFCs as and when there is an established need for that encapsulation type.

Control Plane Separation

- The control plane solutions should be written up independently of the data-plane.
- The description of each control plane should specify the encapsulation technology as a parameter and thus be usable in configuring future encapsulation technologies as and when they become important and are documented.

Proposal

- This is a simple solution to a simple problem.
- It would be useful to have the problem discussed in the SPRING WG and have experts there flag up concerns and missing functions.
- In our view the solution to this problem belongs in the MPLS WG.