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D. Voyer, Ed.
Bell Canada
C. Filsfils
R. Parekh
Cisco Systems, Inc.
H. Bidgoli
Nokia
Z. Zhang
Juniper Networks
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SR Replication Segment for Multi-point Service Delivery
draft-voyer-spring-sr-replication-segment-02

Abstract

This document describes the SR Replication segment for multi-point service delivery. A SR Replication segment allows a packet to be replicated from a replication node to downstream nodes.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on May 29, 2020.

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1. Introduction

We define a new type of segment for Segment Routing [RFC8402], called Replication segment, which allows a node (henceforth called as Replication Node) to replicate packets to a set of other nodes (called Downstream Nodes) in a Segment Routing Domain. Replication segments provide building blocks for Point-to-Multi-point Service delivery. A Replication segment at ingress node of multi-point service could replicates packets directly to each egress node of the service (without need for any state on the internal routers), or it could be stitched to other Replication segments to build a tree in SR domain for multi-point service. The latter is outside the scope of this document but specified in [I-D.voyer-pim-sr-p2mp-policy].

2. Replication Segment

In a Segment Routing Domain, a Replication segment is a logical segment which connects a Replication Node to a set of Downstream Nodes. A Replication segment can be either provisioned locally on a

node or programmed by a PCE. Replication segments apply equally to both SR-MPLS and SRv6 instantiations of Segment Routing.

A Replication segment is identified by the tuple <Replication-ID, Node-ID>, where:

- Replication-ID: An identifier for a Replication segment that is unique in context of the Replication Node.

- Node-ID: The address of the Replication Node that the Replication segment is for. Note that the root of a multi-point service is also a replication node.

In simplest case, Replication-ID can be a 32-bit number, but it can be extended or modified as required based on specific use of a Replication segment. When the PCE signals a Replication segment to its node, the <Replication-ID, Node-ID> tuple identifies the segment. Examples of such signaling and extension are described in [I-D.voyer-pim-sr-p2mp-policy].

A Replication segment includes the following elements:

- Replication SID: The Segment Identifier of a Replication segment. This is a SR-MPLS label or a SRv6 SID [RFC8402].

- Downstream Nodes: Set of nodes in Segment Routing domain to which a packet is replicated by the Replication segment.

- Replication State: See below.

The Downstream Nodes and Replication State of a Replication segment can change over time, depending on the network state and leaf nodes of a multi-point service that the segment is part of.

Replication State is a list of replication branches to the Downstream Nodes. In this document, each branch is abstracted to a <Downstream Node, Downstream Replication SID> tuple. A Downstream Node could be represented by the node's Node SID (i.e. it does not matter how traffic gets to the Downstream Node, whether it's directly connected or not), or in case of a directly connected node it could be represented by the Adjacency SID (for the interface connecting to the directly connected Leaf Node). Alternatively, a Downstream Node could be represented by a SID-list or a Segment Routing Policy [I-D.ietf-spring-segment-routing-policy] that partially/fully specifies the explicit path from the Replication Node to the Downstream Node, or even represented by another Replication segment.

Replication SID identifies the Replication segment in the forwarding plane. For the root of a multi-point service, the Replication SID SHOULD be considered to be the equivalent of Binding SID [I-D.ietf-spring-segment-routing-policy] of a Segment Routing Policy. At a downstream node of the multi-point service, the Replication SID MAY be used to identify that portion of the multi-point service.

A packet steered into a Replication segment at a node is replicated to each Downstream Node with the Downstream Replication SID that is relevant at that node. A packet is steered into a Replication Segment in two ways:

- When the Active Segment [RFC8402] is the Replication SID. In this case, the operation for a replicated copy is CONTINUE.

- On the root of a multi-point service, based on local policy-based routing. In this case, the operation for a replicated copy is PUSH.

If a Downstream Node is an egress (aka leaf) of the multi-point service, i.e. no further replication is needed, then that leaf node's Replication segment will not have any Replication State and the operation is NEXT. Notice that the segment on the leaf node is still referred to as a Replication segment for the purpose of generalization.

A node can be a bud node, i.e. it is a replication node and a leaf node of a multi-point service at the same time [I-D.voyer-pim-sr-p2mp-policy]. In this case, the Replication segment's Replication State includes a branch with the Downstream Node being itself and the operation for the replicated copy is NEXT.

3. Use Cases

In the simplest use case, a single Replication segment includes the root node of a multi-point service and the egress/leaf nodes of the the service as all the Downstream Nodes. This achieves Ingress Replication [RFC7988] that has been widely used for MVPN [RFC6513] and EVPN [RFC7432] BUM (Broadcast, Unknown and Multicast) traffic.

Replication segments can also be used as building blocks for replication trees when Replication segments on the root, intermediate replication nodes and leaf nodes are stitched together to achieve efficient replciation. That is specified in [I-D.voyer-pim-sr-p2mp-policy].

4. IANA Considerations

This document makes no request of IANA.

5. Security Considerations

There are no additional security risks introduced by this design.

6. Acknowledgements

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7. Contributors

Clayton Hassen
Bell Canada
Vancouver
Canada

Email: clayton.hassen@bell.ca

Kurtis Gillis
Bell Canada
Halifax
Canada

Email: kurtis.gillis@bell.ca

Arvind Venkateswaran
Cisco Systems, Inc.
San Jose
US

Email: arvvenka@cisco.com

Zafar Ali
Cisco Systems, Inc.
US

Email: zali@cisco.com

Swadesh Agrawal
Cisco Systems, Inc.
San Jose
US

Email: swaagraw@cisco.com

Jayant Kotalwar
Nokia
Mountain View
US

Email: jayant.kotalwar@nokia.com

Tanmoy Kundu
Nokia
Mountain View
US

Email: tanmoy.kundu@nokia.com

Tarek Saad
Juniper Networks
Canada

Email:tsaad@juniper.net

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Authors' Addresses

Daniel Voyer (editor)
Bell Canada
Montreal
CA

Email: daniel.voyer@bell.ca

Clarence Filsfils
Cisco Systems, Inc.
Brussels
BE

Email: cfilsfil@cisco.com

Rishabh Parekh
Cisco Systems, Inc.
San Jose
US

Email: riparekh@cisco.com

Hooman Bidgoli
Nokia
Ottawa
CA

Email: hooman.bidgoli@nokia.com

Zhaohui Zhang
Juniper Networks

Email: zzhang@juniper.net