Extensions to RT-Constrain in Hierarchical Route Reflection Scenarios
draft-dong-idr-rtc-hierarchical-rr-02

Abstract

   The Route Target (RT) Constrain mechanism specified in RFC 4684 is
   used to build a route distribution graph in order to restrict the
   propagation of Virtual Private Network (VPN) routes. In network
   scenarios where hierarchical route reflection (RR) is used, the
   existing RT-Constrain mechanism cannot build a correct route
   distribution graph. This document describes the problem scenario and
   proposes a solution to address the RT-Constrain issue in hierarchical
   RR scenarios.

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

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1. Introduction

   The Route Target (RT) Constrain mechanism specified in [RFC4684] is
   used to build a route distribution graph in order to restrict the
   propagation of Virtual Private Network (VPN) routes. In network
   scenarios where hierarchical route reflection (RR) is used, the
   existing advertisment rules of RT membership information as defined
   in section 3.2 of [RFC4684] cannot guarantee a correct route
   distribution graph.

   This document describes the problem scenario and proposes a solution
   to address the RT-Constrain issue in hierarchical RR scenarios.

2. Problem Statement

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            +--------------------------------+
            |            +----+              |
            |      Clu-1 |RR-1|              |
            |            /+----+\            |
            |          /         \           |
            |      +----+     +----+         |
            |  Clu-2 |RR-2|     |RR-3|  Clu-3 |
            |      +-/--+     +/--\+         |
            |        /         /    \        |
            |    +----+     +----+     +----+  |
            |    |PE-1|     |PE-2|     |PE-3|  |
            |    +----+     +----+     +----+  |
            |      |          |          |    |
            +-------|----------|---------|----+
               RT-1 |     RT-1 |          | RT-1
               +--------+   +--------+   +--------+
               | VPN-1 |   | VPN-1 |   | VPN-1 |
               +--------+   +--------+   +--------+
```
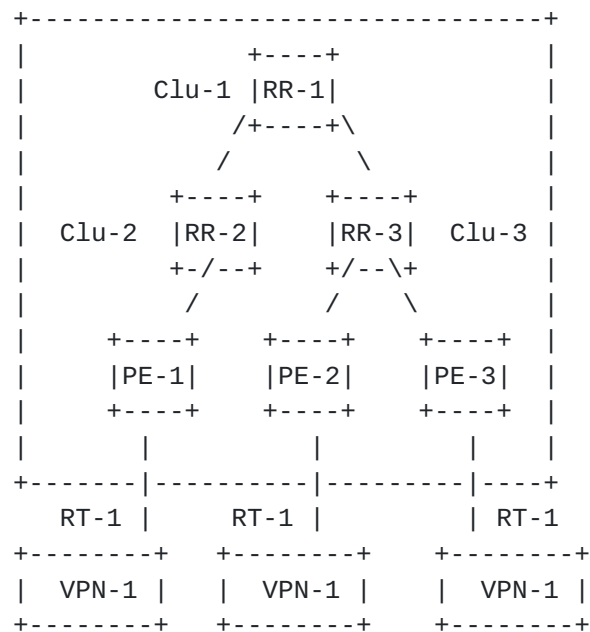Figure 1. RT-Constrain with Hierarchical RR

As shown in Figure 1, hierarchical RRs are deployed in the network,
RR-2 and RR-3 are route-reflectors of their connecting PEs, and are
also the clients of RR-1. If each PE advertises RT membership
information of RT-1 to the upstream RR, after the best path
selection, both RR-2 and RR-3 would create the CLUSTER_LIST
attribute, prepend their local CLUSTER_ID and then advertise the best
path to RR-1 and their clients respectively.

On receipt of the RT-Constrain routes from RR-2 and RR-3, RR-1 will
select one of the received routes as the best route, here assume the
route received from RR-2 is selected by RR-1 as the best path. Then
RR-1 needs to advertise the best path to both RR-2 and RR-3 to create
the route distribution graph of VPN-1. RR-1 would prepend its
CLUSTER_ID to the CLUSTER_LIST of the path, and according to the
rules in Section 3.2 of [RFC4684], it sets the ORIGINATOR_ID to its
own router-id, and the NEXT_HOP to the local address for the session.
Then RR-1 would advertise this route to both RR-2 and RR-3. On
receipt of the RT-Constrain route from RR-1, RR-2 checks the
CLUSTER_LIST and find its own CLUSTER_ID in the list, so this route
will be ignored by RR-2. As a result, RR-2 will not form the
outbound filter of RT-1 towards RR-1, hence will not advertise VPN
routes with RT-1 to RR-1.

3. Proposed Solution

3.1. Add-path Based Solution

During the discussion in the IDR working group, the add-path based
solution is proposed. It makes use of the add-path mechanism as
defined in [I-D.ietf-idr-add-paths] for RTC route advertisement. The
solution is summerized as follows:

o The route-reflector clients which themselves are also route-
   reflectors SHOULD be identified, then BGP add-paths
   [I-D.ietf-idr-add-paths] SHOULD be enabled for RT membership NLRI
   on the BGP sessions between the higher layer RR and the lower
   layer RRs to ensure that sufficient RT-Constrain routes can be
   advertised by the higher layer RR to the lower layer RRs to pass
   BGP loop detection. In this case normal BGP path advertisement
   rules as defined in [RFC4271] SHOULD be applied. The number of
   RT-Constrain routes to be advertised is a local decision of
   operators.

o When advertising an RT membership NLRI to a route-reflector client
   which is not a lower layer RR, the advertisement rule as defined
   in section 3.2 of [RFC4684] SHOULD be applied.

With the above advertisement rule, RR-1 in figure 1 SHOULD advertise
to RR-2 the RT-Constrain routes received from both RR-2 and RR-3,
then the RTC route from RR-3 will pass the BGP loop detection on RR-
2, thus the route distribution graph can be set up correctly.

4. IANA Considerations

This document makes no request of IANA.

5. Security Considerations

This document does not change the security properties of BGP based
VPNs and [RFC4684].

6. Acknowledgements

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RT-Constrain in hierarchical RR scenario. Many people have made
valuable comments and suggestions, including Susan Hares, Jeffrey
Haas, Stephane Litkowski, Vitkovsky Adam, Xiaohu Xu, Uttaro James,
Shyam Sethuram and Saikat Ray.

7. **Normative References**

[I-D.ietf-idr-add-paths]
            Walton, D., Retana, A., Chen, E., and J. Scudder,
            "Advertisement of Multiple Paths in BGP", draft-ietf-idr-
            add-paths-10 (work in progress), October 2014.

[RFC2119]   Bradner, S., "Key words for use in RFCs to Indicate
            Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC4271]   Rekhter, Y., Li, T., and S. Hares, "A Border Gateway
            Protocol 4 (BGP-4)", RFC 4271, January 2006.

[RFC4684]   Marques, P., Bonica, R., Fang, L., Martini, L., Raszuk,
            R., Patel, K., and J. Guichard, "Constrained Route
            Distribution for Border Gateway Protocol/MultiProtocol
            Label Switching (BGP/MPLS) Internet Protocol (IP) Virtual
            Private Networks (VPNs)", RFC 4684, November 2006.

Appendix A. **Another Possible Solution**

This section provides another possible solution which was discussed
among authors and IDR participants.

Since the advertisement of RT-Constrain route is to set up a route
distribution graph and not to guide the data packet forwarding,
actually all the available RT-Constrain routes should be considered
in setting up the route distribution graph, not just the best one.
Thus the following advertisment rule for RT membership information is
proposed to replace the rule i and ii in section 3.2 [RFC4684]:

o When advertising an RT membership NLRI to a route-reflector peer
   (either client or non-client), if the best path as selected by the
   path selection procedure described in Section 9.1 of [RFC4271] is
   the path received from this peer, and there are alternative paths
   received from other peers, then the most disjoint alternative
   route SHOULD be advertised to this peer. The most disjoint
   alternative path is the path whose CLUSTER_LIST and ORIGINATOR_ID
   attributes are diverse from the attributes of the best path.

With the above advertisement rule, RR-1 in figure 1 would advertise
to RR-2 the RT-Constrain route received from RR-3, although the best
route is received from RR-2. Thus RR-2 will not discard the RT-
constrain route received from RR-1, and the route distribution graph
can be set up correctly.

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