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Extended Communities Derived from Route Targets

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Abstract

This document specifies a way to derive an Extended Community from a Route Target and describes some example use cases.

Status of This Memo

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1. Introduction

Consider a VPN with 10 PEs. A Route Target (say RT1) [RFC4360] is configured for the VPN, and all PEs will import VPN routes with RT1 into their corresponding VRF. The RT is an Extended Community (say EC1), with its sub-type being 0x02. While RT1 and EC1 have the same encoding, typically, when we mention a Route Target, its property of being able to control the route propagation and importation is implied. When we just mention an Extended Community, that property is not implied.

Now consider that another BGP route needs to be imported by some but not all those PEs into their VRF. The route could be of any SAFI/ type (it may not need to be a VPN prefix), but it needs to be associated with the VPN on those PEs. The exact meaning of "association" here does not matter, but the key is that those PEs need to know that the route is related to that VPN. Some examples of the association are given in Section 5.1 and Section 5.2.

To control the propagation to those PEs, a different Route Target (say RT3) is attached to the route. For those PE to associate the route with the VPN, an Extended Community (say EC2) is attached. Even though RT1/EC1 is already used for route importation into the VPN, EC2 needs to be different from RT1/EC1, because if EC1 was used, the route would be propagated to and imported by all the 10 PEs. EC2 cannot be the same as RT3 either, because there could be other routes to be propagated to those same set of PEs, yet those other routes are not related to the VPN.

While EC2 can be any Extended Community (that is not an RT) configured on the originating and receiving PEs to map it to the VPN, it is convenient if EC2 is derived from the RT1/EC1, e.g. the sub-type of RT1/EC1 is changed to a new known value while everything else remains the same. We call this a Route Target Derived Extended Community, or RT-derived EC, with a new sub-type assigned specifically for this purpose (Section 3).

2. Specification

While in the above example, an RT-derived EC is used for the purpose of importing routes to a VRF configured with the corresponding Route Target, this document only specifies a way to derive an Extended Community from a Route Target Extended Community using IANA-assigned Extended Community sub-types (or Extended Community Type in case of IPv6-Address-Specific Extended Community [RFC5701]), as detailed in Section 3.

RT-derived ECs are not used inherently to control the propagation of routes that carry them.

Any AFI/SAFI or BGP-based protocol/feature that can take advantage of the convenience of generic derivation may use them, or not use them at its own discretion. How they are used is outside the scope of this document, but should be specified in documents for the specific use cases.

3. IANA Assignments

IANA has assigned a new sub-type "RT-derived-EC" with value 0x15 in the following registries:

* Transitive Two-Octet AS-Specific Extended Community Sub-Types
* Transitive Four-Octet AS-Specific Extended Community Sub-Types
* Transitive IPv4-Address-Specific Extended Community Sub-Types
* Non-Transitive Opaque Extended Community Sub-Types
* EVPN Extended Community Sub-Types

IANA has also assigned a new type "RT-derived-EC" with value 0x0015 in the following registry:

* Transitive IPv6-Address-Specific Extended Community Types

This document additionally requests IANA to assign a new sub-type "RT-derived-EC" with value 0x15 in the following registries:

* Transitive Transport Class Extended Community Sub-Types

* Non-Transitive Transport Class Extended Community Sub-Types

4. A Note on Route Target Type/sub-type Conventions

It may be expected by some people that Route Targets are Extended Communities with sub-type 0x02 (or with Type 0x0002 in case of IPv6 Address Specific Extended Community). However, IANA has only registered Route Targets for the following types:

* Type 0x00 (Transitive Two-Octet AS-Specific EC)

* Type 0x01 (Transitive IPv4-Address-Specific EC)

* Type 0x02 (Transitive Four-Octet AS-Specific EC)

* Type 0x43 (Non-Transitive Opaque Extended EC)

* Type 0x06 (EVPN AS-Specific EC)

* Type 0x0002 (Transitive IPv6-Address-Specific Route Target)

* Type 0x0011 (Transitive IPv6-Address-Specific EC, UUID-based Route Target))

While it may be desired to follow the unwritten convention and assign sub-type 0x02 for future Route Targets of future types of ECs, there is no guarantee of that. For example, Type 0x0011 (which can be interpreted as with a sub-type 0x11) is assigned for UUID-based Route Target that imposes as an IPv6 Address Specific EC (even though UUID is not an IPv6 address).

When a new type of extended community is defined and registered, and a sub-type under this new type is registered for Route Target purposes, it is suggested to also register a sub-type for derivation purposes, preferably with the same value 0x15. However, there is no guarantee of that either.

5. Use Cases

The following are a few examples of use cases. To reiterate, these are example scenarios where generic RT-derived ECs could be used (when the routes to which they are attached provide enough context). It is not the intention of this document to mandate that it must be used.

5.1. EVPN EVI-RT Extended Community

Section 9.5 "EVI-RT Extended Community" of [RFC9251] describes a situation similar to the above. As a solution, four EVPN specific EVI-RT ECs are defined, each mapping to a type of Route Target for the corresponding EVPN instance.

As a theoretical alternative, an RT-derived EC described in this document could be used instead - just derive a generic EC from the EVI RT. Note that this document does not attempt to change the existing procedures in [RFC9251], but merely use it for illustration purposes.

5.2. Leaf Discovery with Controller Signaled BGP-MVPN

In Section 2 "Alternative to BGP-MVPN" of [I-D.ietf-bess-bgp-multicast-controller], BGP MCAST-TREE SAFI signaling can be used for a controller to program multicast forwarding state in VRFs of ingress/egress PEs, instead of relying on distributed BGP-MVPN signaling. For the controller to learn egress PEs of a VPN customer multicast tree (so that it can build/find a corresponding provider tunnel), egress PEs signal leaf information to the controller via Leaf Auto-Discovery routes. The routes carry a Route Target for the controller (so that only the controller receives them), and an EC derived from the VPN’s Route Target (so that the controller knows which VPN they are for).

5.3. Translated Route-target Extended Communities in [I-D.ietf-idr-legacy-rtc]

Section 3.1 of [I-D.ietf-idr-legacy-rtc] uses the derivation as quoted below:

"Using the TRTS translated from the IRTS is necessary in order to refrain from importing "route-filter" VRF routes into VPN VRFs that would import the same route-targets. The translation from the IRTS is done as follows. For a given IRT, the equivalent translated RT (TRT) is constructed by means of swapping the value of the low-order octet of the Type field for the IRT (as specified in [I-D.ietf-idr-rt-derived-community])."

6. Security Considerations

This document specifies a way to derive an Extended Community from a Route Target Extended Community and does not specify how derived Extended Communities are used. As a result, this document does not need security considerations. Any potential security concerns need be addressed by documents that specify the actual usage. Additionally, in general one should pay attention to stripping unintended received ECs from external peers.

7. Acknowledgements

The authors thank Robert Raszuk for his valuable comments and suggestions.

8. References

8.1. Normative References

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[RFC5701] Rekhter, Y., "IPv6 Address Specific BGP Extended Community Attribute", RFC 5701, DOI 10.17487/RFC5701, November 2009, <https://www.rfc-editor.org/info/rfc5701>.

8.2. Informative References

[RFC9251] Sajassi, A., Thoria, S., Mishra, M., Patel, K., Drake, J., and W. Lin, "Internet Group Management Protocol (IGMP) and Multicast Listener Discovery (MLD) Proxies for Ethernet VPN (EVPN)", RFC 9251, DOI 10.17487/RFC9251, June 2022, <https://www.rfc-editor.org/info/rfc9251>.

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