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Multi-Topology/Multi-Instance OSPFv3 for IPv4-Embedded IPv6
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Abstract

This memo defines two new Multi Topology Routing Identifiers (MT IDs), based on [[I-D.ietf-ospf-mt-ospfv3](#)] and two new Instance Identifiers (MI IDs), based on [[I-D.ietf-ospf-af-alt](#)], respectively, in OSPFv3. With these identifiers, an IPv4-Embedded IPv6 topology is maintained for both IPv6 unicast and multicast traffic. The purpose of running separate instances or topologies for IPv4- Embedded IPv6 traffic is to distinguish from the native IPv6 routing topology, and the topology that is used for routing IPv4-Embedded IPv6 datagrams only. Separate instances/topologies are also meant to prevent any overload of the native IPv6 routing tables by IPv4-Embedded IPv6 routes.

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](#)].

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1. Introduction

Within the double context of public IPv4 address exhaustion and IPv6-IPv4 interconnection, numerous solutions are being elaborated within IETF. Both translation (e.g., [[I-D.ietf-behave-v6v4-xlate-stateful](#)] and [[I-D.ietf-behave-v6v4-xlate](#)]) and encapsulation (e.g., [[I-D.boucadair-dslite-interco-v4v6](#)] and [[I-D.boucadair-behave-ipv6-portrange](#)]) based schemes are proposed to allow IPv6-IPv4 interconnection. These solutions require the injection of routes to IPv4-Embedded IPv6 prefixes [[I-D.ietf-behave-address-format](#)] in intra-domain routing protocols .

In order to prevent any overload of the native IPv6 routing table with IPv4-Embedded IPv6 routes, this document defines new MT IDs (resp., MI IDs) which are required for the activation of multiple topologies (resp., Instances), where the native IPv6 topology (resp., Instance) would be distinct from the IPv4-Embedded IPv6 topology (resp., Instance). Operational reasons also motivate this approach which is meant to ease the migration to full IPv6. As a result, the unicast IPv4- Embedded IPv6 topology (resp., Instance) is used for unicast IPv4- Embedded IPv6 route computation purposes, and the multicast IPv4- Embedded IPv6 topology (resp., Instance) is used for multicast IPv4- Embedded IPv6 route computation purposes.

This document does not make any preference between the solution described in [[I-D.ietf-ospf-mt-ospfv3](#)] and [[I-D.ietf-ospf-af-alt](#)]. Network administrators have to make their decisions based on local policies. If the multi-instance mechanism is deployed in an OSPFv3 network as a preference for multiple topologies, the MI extensions

defined in this document may be used to support unicast/multicast IPv4-Embedded IPv6 routing. If MT-OSPFv3 mechanism is deployed in an OSPFv3 network as a preference for multiple topologies, the MT extensions defined in this document may be used to support unicast/multicast IPv4-Embedded IPv6 routing.

2. IPv4-Embedded IPv6 OSPFv3 Topologies

MT-OSPFv3 [[I-D.ietf-ospf-mt-ospfv3](#)] is a mechanism that has been specified to run various topologies based on several criteria such as the need to distinguish the IPv6 unicast topology from the IPv4 routing topology. Distinct MT IDs (Multi-Topology Identifiers) are assigned by IANA (e.g., MT ID# 0 for IPv6 routing topology, MT ID# 3 for IPv6 multicast topology, etc.). MT ID #5-#31 range is reserved for IETF consensus. This document requests the assignment of two new MT IDs for the following usages:

- o IPv4-Embedded IPv6 unicast topology;
- o IPv4-Embedded IPv6 multicast topology.

3. IPv4-Embedded IPv6 OSPFv3 Instances

[I-D.ietf-ospf-af-alt] specifies a mechanism to map each address family (AF) to a separate OSPFv3 [[RFC5340](#)] Instance identified by an ID. Many Instance IDs have been reserved for different AF (e.g., Instance ID#0 - #31 for IPv6 unicast AF, Instance ID#32 - #63 for IPv6 multicast AF, etc.). Instance ID#0 is used by default for IPv6 unicast AF. This document requests the assignment of two new Instance IDs for the IPv4-Embedded IPv6 AF:

- o IPv4-Embedded IPv6 unicast AF;
- o IPv4-Embedded IPv6 multicast AF.

4. Provisioning

Adequate provisioning must be done according to [[I-D.ietf-ospf-mt-ospfv3](#)] and [[I-D.ietf-ospf-af-alt](#)], respectively, based on the corresponding mechanism that is actually used in an OSPFv3 network, in order to have a fully-connected IPv4-Embedded IPv6 unicast or multicast topology.

5. Procedure

This document does not require any modification to the procedure specified in [[I-D.ietf-ospf-mt-ospfv3](#)] nor in [[I-D.ietf-ospf-af-alt](#)]. Nevertheless, routes to IPv4-Embedded IPv6 addresses or prefixes MUST be instantiated within an IPv4-Embedded IPv6 MT-OSPFv3 (resp., MI-OSPFv3). Concretely, the IANA prefix defined in [[I-D.ietf-behave-address-format](#)] MUST be supported by default. Service providers MAY also choose a LIR prefix to build the IPv4-Embedded IPv6 addresses.

6. Advertising IPv4-Embedded IPv6 Routes

With one of the mechanisms (i.e., a separate OSPFv3 instance or a separate OSPFv3 topology) as described above, reachability of IPv4-Embedded IPv6 destinations can be advertised in an IPv6 network using OSPFv3.

In general, IPv4-Embedded IPv6 addresses and prefixes are advertised into an OSPFv3 network using AS External LSA [[RFC5340](#)], i.e.- with the advertising scope throughout the entire Autonomous System. This is because an advertising node in this case is most likely connected to one or more IPv4 networks, and as such, it functions as an Autonomous System Boundary Router (ASBR) in the perspective of OSPFv3 routing domain. Any OSPFv3 area that does not want to receive such advertisement can be configured as a stub area or with other routing policy.

By default, the metric in an AS External LSA that carries one or more IPv4-Embedded IPv6 addresses and prefixes is a Type 1 external metric, which is then to be added to the metric of an intra-AS path during OSPFv3 routes calculation. By configuration on an ASBR, the metric can be set to a Type 2 external metric, which is considered

much larger than any intra-AS path. The detail is referred to OSPFv3 specification [[RFC5340](#)]. In either case, an external metric may be exact the same unit as in an IPv4 network (running OSPFv2 or others), but may also be specified by a routing policy, the detail is outside of the scope of this document.

Advertising IPv4-Embedded IPv6 addresses and prefixes using OSPFv3 inter-area prefix LSA is for future study.

[7.](#) Forwarding

Only incoming datagrams destined to IPv4-Embedded IPv6 addresses are associated (and forwarded accordingly) with the IPv4-Embedded IPv6 unicast/multicast topology, respectively. WKP (i.e., 64:FF9B::/96) and/or LIR prefix defined in [[I-D.ietf-behave-address-format](#)] MUST be configured in all participating nodes.

[8.](#) IANA Considerations

This document requests the following MT-OSPFv3 IDs:

- o MT ID# for IPv4-Embedded IPv6 unicast topology
- o MT ID# for IPv4-Embedded IPv6 multicast topology.

and the following OSPFv3 Instance IDs:

- o Instance ID# for IPv4-Embedded IPv6 unicast AF;
- o Instance ID# for IPv4-Embedded IPv6 multicast AF.

[9.](#) Security Considerations

This document does not introduce any security issue in addition to those defined in [[RFC5340](#)].

[10.](#) Acknowledgements

[11.](#) References

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