                    H-bit Support for OSPFv2
                   draft-ietf-ospf-ospfv2-hbit-06

Abstract

   OSPFv3 defines an option bit for router-LSAs known as the R-bit in
   RFC5340. If the R-bit is clear, an OSPFv3 router can participate in
   OSPF topology flooding, however it will not be used as a transit
   router. In such cases, other routers in the OSPFv3 routing domain
   only install routes to allow local traffic delivery. This document
   defines the H-bit functionality to prevent other OSPFv2 routers from
   using the router for transit traffic in OSPFv2 routing domains as
   described in RFC 2328. This document updates RFC 2328.

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1. Introduction

OSPFv3 [RFC5340] defines an option bit for router-LSAs known as the
R-bit. If the R-bit is clear, an OSPFv3 router can participate in
OSPFv3 topology flooding without acting as a transit router. In such
cases, other routers in the OSPFv3 routing domain only install routes
used for local traffic.

This functionality is particularly useful for BGP Route Reflectors,
known as virtual Route Reflectors (vRRs), that are not in the
forwarding path but are in central locations such as data centers.
Such Route Reflectors typically are used for route distribution and

are not capable of forwarding transit traffic. However, they need to
learn the OSPF topology for:

1. SPF computation for Optimal Route Reflection functionality as
    defined in [I-D.ietf-idr-bgp-optimal-route-reflection]

2. Reachability resolution for its Route Reflector Clients.

This document defines the R-bit functionality equivalent for OSPFv2
defined in [RFC2328] by introducing a new router-LSA bit known as the
"H-bit". This document updates appendix A.4.2 of RFC 2328.

2. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
"SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and
"OPTIONAL" in this document are to be interpreted as described in BCP
14 [RFC2119] [RFC8174] when, and only when, they appear in all
capitals, as shown here.

3. H-bit Support

This document defines a new router-LSA bit known as the Host Bit or
the H-bit. An OSPFv2 router advertising a router-LSA with the H-bit
set indicates to other OSPFv2 routers in the area supporting the
functionality that it MUST NOT be used as a transit router. The bit
value usage of the H-bit is reversed from the R-bit defined in OSPFv3
[RFC5340] to support backward compatibility. The modified OSPFv2
router-LSA format is:

```
      0                   1                   2                   3
      0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |            LS age             |   Options   |      1        |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                        Link State ID                        |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                      Advertising Router                     |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                      LS sequence number                     |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |       LS checksum            |             length           |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |H|0|0|N|W|V|E|B|       0      |             # links          |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                          Link ID                            |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                          Link Data                          |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |     Type      |    # TOS      |             metric          |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                           ...                               |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |     TOS       |      0        |            TOS  metric      |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                          Link ID                            |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                          Link Data                          |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                           ...                               |
```

     bit H
          When set, an OSPFv2 router is a non-transit router and is
          incapable of forwarding transit traffic.

   When the H-bit is set, an OSPFv2 router is a non-transit router and
   should not be used to forward transit traffic. In this mode, the
   other OSPFv2 routers in the area SHOULD NOT use the originating
   OSPFv2 router for transit traffic, but MAY use the OSPFv2 router for
   local traffic destined to that OSPFv2 router.

   An OSPFv2 router originating a router-LSA with the H-bit set SHOULD
   advertise all its non-local router links with a link cost of
   MaxLinkMetric as defined in Section 3 of [RFC6987]. This is to
   increase the applicability of the H-bit to partial deployments where
   it is the responsibility of the operator to ensure that OSPFv2

routers not supporting the H-bit do not install routes causing
routing loops.

When the H-bit is set, IPv4 prefixes associated with local interfaces
in other areas MAY be advertised in summary LSAs. Non-local IPv4
prefixes, e.g., those advertised by other routers and installed
during the SPF computation, MAY be advertised in summary-LSAs if
configured by policy. Likewise, when the H-bit is set, only IPv4
prefixes associated with local interfaces MAY be advertised in AS-
external LSAs. Non-local IPv4 prefixes, e.g., those exported from
other routing protocols, MUST NOT be advertised in AS-external-LSAs.
Finally, when the H-bit is set, an Area Border Router (ABR) MUST
advertise a consistent H-bit setting in its self-originated router-
LSAs for all attached areas.

4. SPF Modifications

The SPF calculation described in section 16.1 [RFC2328] will be
modified to ensure that the routers originating router-LSAs with the
H-bit set will not be used for transit traffic. Step 2 is modified
as follows:

> 2) Call the vertex just added to the
>   tree vertex V. Examine the LSA
>   associated with vertex V. This is
>   a lookup in the Area A's link state
>   database based on the Vertex ID. If
>   this is a router-LSA, and the H-bit
>   of the router-LSA is set, and
>   vertex V is not the root, then the
>   router should not be used for transit
>   and step (3) should be executed
>   immediately. If this is a router-LSA,
>   and bit V of the router-LSA (see
>   Section A.4.2) is set, set Area A's
>   TransitCapability to TRUE. In any case,
>   each link described by the LSA gives
>   the cost to an adjacent vertex. For
>   each described link, (say it joins
>   vertex V to vertex W):

5. Auto Discovery and Backward Compatibility

To avoid the possibility of any routing loops due to partial
deployment, this document defines a OSPF Router-Information LSA
functional capability bit known as the Host Support capability.

   Auto Discovery via announcement of the Host Support Functional
   Capability ensures that the H-bit functionality and its associated
   SPF changes SHOULD only take effect if all the routers in a given
   OSPF area support this functionality.

   Implementations are encouraged to provide a configuration parameter
   to manually override enforcement of the H-bit functionality in
   partial deployments where the topology guarantees that OSPFv2 routers
   not supporting the H-bit do not compute routes resulting in routing
   loops. More precisely, the advertisement of MaxLinkMetric for the
   router's non-local links will prevent OSPFv2 routers not supporting
   the H-bit from attempting to use it for transit traffic.

6. OSPF AS-External-LSAs/NSSA LSAs with Type 2 Metrics

   When calculating the path to an OSPF AS-External-LSA or NSSA-LSA with
   a Type-2 metric, the advertised Type-2 metric is taken as more
   significant than the OSPF intra-area or inter-area path. Hence,
   advertising the links with MaxLinkMetric as specified in [RFC6987]
   does not discourage transit traffic when calculating AS external or
   NSSA routes. Consequently, OSPF routers implementing [RFC6987] or
   this specification should advertise a Type-2 metric of LSInfinity for
   any self-originated AS-External-LSAs or NSSA-LSAs in situations when
   the OSPF router is acting as a stub router [RFC6987] or implementing
   this specification.

7. IANA Considerations

   IANA is requested to create the OSPF Router-LSA bit registry with the
   following assignments:

```
        Value    Description                              Reference
        0x01     Area Border Router (B-bit)               [RFC2328]
        0x02     AS Boundary Router (E-bit)               [RFC2328]
        0x04     Virtual Link Endpoint (V-bit)            [RFC2328]
        0x08     Historic (W-bit)                         [RFC1584]
        0x10     Unconditional NSSA Translator (Nt-bit)   [RFC3101]
        0x20     Unassigned
        0x40     Unassigned
        0x80     Host (H-bit)                         This Document
```

   This document also defines a new Router Functional Capability
   [RFC7770] known as the Host Support Functional Capability. This
   document requests IANA to allocate the value of this capability from
   the Router Functional Capability Bits TLV.

8. Security Considerations

   This document introduces no new security considerations beyond those
   already specified in [RFC6987], [RFC2328], and [RFC5340].

9. Acknowledgements

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   the limitation in [RFC6987], Acee Lindem, Abhay Roy, David Ward,
   Burjiz Pithawala and Michael Barnes for their comments.

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