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Advertising Unreachable Links in OSPF
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Abstract

In certain scenarios, it is necessary to advertise OSPF links that are not applicable to the default SPF (Shortest Path First) calculation for other purposes. In order to advertise these links and not use them in the base SPF calculation, the metric LSLinkInfinity (0xffff) is used to specify that the link is unreachable.

Stub Router Advertisement (RFC 6987) defines MaxLinkMetric (0xffff) to indicate a router-LSA link should not be used for transit traffic. When an OSPFv2 router supports the Unreachable Link support capability defined in this document, OSPFv2 Stub Router links are advertised as MaxReachableLinkMetric (0xfffe) rather than MaxLinkMetric (0xffff). This document updates RFC 6987 and RFC 8770 with respect to the advertisement of MaxReachableLinkMetric rather than MaxLinkMetric.

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 22 March 2026.

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1. Introduction

In certain scenarios, it is necessary to advertise OSPF links that are not applicable to the default SPF calculation for other purposes. For example, a link may be available for Traffic Engineering (TE) purposes but not suitable for hop-by-hop routing. Another example is an OSPF link used exclusively by a Flexible Algorithm [RFC9350] but excluded from the default algorithm.

In order to advertise these links as unreachable, the metric LSLinkInfinity (0xffff) is used to specify that the link is unreachable and OSPF routers supporting this specification will exclude the link from SPF calculations (subject to backward-compatibility constraints, refer to Section 3.2).

1.1. 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.

2. Use Cases

2.1. Case 1: Traffic Engineering

A network topology is shown in Figure 1. The OSPF link between Node A and E is only to be used for traffic engineering. Since the OSPF link is advertised by default, it will be included in the base SPF calculation for the default topology and may be used for hop-by-hop routing in the default topology.

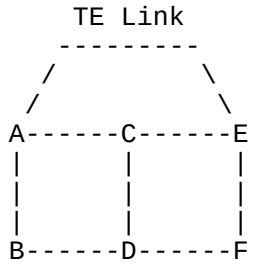

Figure 1: Network Topology

2.2. Case 2: Flexible Algorithm

A network topology is shown in Figure 2. The links between nodes A and B and between C and D are to be used exclusively for a flex-algorithm [RFC9350] devoted to specific traffic. These links have an Extended Administrative Group (EAG) [RFC7308] attribute specifying the "Red" color.

Figure 2: Network Topology

Flex-Algorithm 128 is enabled on Nodes A, B, C, and D, with an EAG rule including "Red" and the Metric-Type is designated to be a type other than the IGP metric. OSPF will compute routes for Flex-Algorithm 128 using these links. The topology associated with Flex-Algorithm 128 is shown in Figure 3.

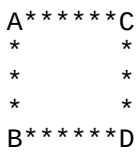

Figure 3: Topology of Flex-Algorithm 128

The "Red" links that are used by Flex-Algorithm 128 calculation. However, these "Red" links are also included in the default algorithm calculation [RFC9350] since they are reachable. Note that links used by the default algorithm are omitted from Figure 3 for clarity.

If the IGP metrics for all the "Red" links are advertised as unreachable, they will be excluded from the default SPF calculation as shown in Figure 4, This allows the "Red" links from A to B and C to D to be used exclusively by the Flex-Algorithm 128 calculation.

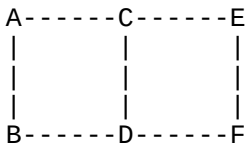

Figure 4: Base SPF Topology Excluding Unreachable Links

3. LSLinkInfinity-Based Solution

3.1. Unreachable Link Advertisement

This document specifies that if the IGP metric of a link is advertised as LSLinkInfinity (0xffff), it MUST NOT be considered during the associated SPF computation. This applies to both the Flex-Algorithm SPF and the base SPF as long as LSLinkInfinity is specified for the IGP metric.

While the interpretation of LSLinkInfinity is only required in the base topology as other topologies are optional [RFC4915], OSPF routers supporting this specification MUST consistently interpret LSLinkInfinity as unreachable during the associated SPF computation. This applies to both the Flex-Algorithm SPF and the base SPF as long as LSLinkInfinity is specified for the IGP metric.

An IGP metric with LSLinkInfinity indicating a link is unreachable is applicable to the following TLVs/LSAs:

* The Router-LSA [RFC2328] [RFC5340]

* The OSPFv2 Extended Link TLV of OSPFv2 Extended Link Opaque LSA [RFC7684]

* The Router-Link TLV of OSPFv3 E-Router-LSA [RFC8362]

3.2. Unreachable Link Backward Compatibility

Prior to this specification, OSPF treated links advertised as LSLinkInfinity as reachable [RFC2328]. Hence, partial deployment of this specification may result in routing loops due to inconsistent interpretation of LSLinkInfinity. For example, in the network shown in Figure 5, link D-F is advertised with LSLinkInfinity (65535/0xffff). Router B supports LSLinkInfinity as unreachable, but router A doesn't. Router A considers link D-F as reachable, and the shortest path to F is A->B->D->F. Router B considers link D-F as unreachable, and the shortest path to F is B->A->C->E->F. As a result, A forwards the packets to B, but B returns them to A, which results in a routing loop.

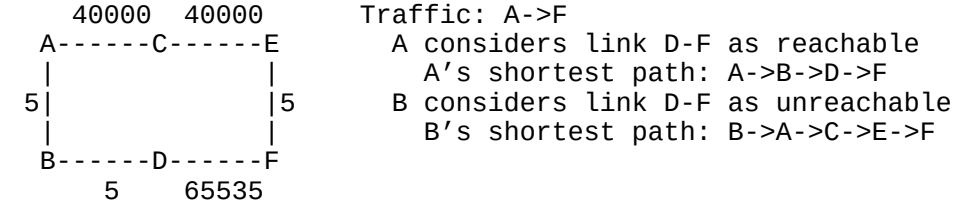

Figure 5: Inconsistent LSLinkInfinity Interpretation Causing Loops

To provide backward compatibility, this document defines that routers supporting LSLinkInfinity for unreachable links MUST advertise a Router Information (RI) LSA with a Router Functional Capabilities TLV [RFC7770] including the following Router Functional Capability Bit:

Bit	Capabilities
TBA	Unreachable Link support

Table 1

OSPF Routers MUST NOT treat links with an advertised metric of LSLinkInfinity as unreachable unless all routers in the OSPF area have advertised this capability. If all OSPF Routers in the area have advertised this capability, then links with an advertised metric of LSLinkInfinity MUST be treated as unreachable. Upon detection of a change in the number of routers in the area not supporting the Unreachable Link support capability changes to 0 or from 0 to greater than 0, all OSPF routers in the area MUST recalculate their routes.

3.3. Stub Router Advertisement Backward Compatibility

Stub Router Advertisement [RFC6987] defines MaxLinkMetric (0xffff) to indicate a router-LSA link should not be used for transit traffic.

When an OSPFv2 router supports the Unreachable Link support capability defined in this document, the OSPFv2 stub router MaxLinkMetric (0xffff) MUST be updated to MaxReachableLinkMetric (0xfffe). This document updates [RFC6987] and [RFC8770] with respect to the advertisement of MaxReachableLinkMetric rather than MaxLinkMetric.

When an OSPFv2 router supports [RFC6987] and the Unreachable Link support capability defined in this document, it MUST also support advertisement all its non-stub links with a link cost of MaxReachableLinkMetric (0xfffe). Since MaxLinkMetric will not be used to indicate a link is unreachable unless all OSPFv2 routers in the area support this specification as specified in Section 3.2, all routers in the area will also support the usage of MaxReachableLinkMetric to discourage the usage of stub router links for transit traffic.

An OSPFv3 router can simply advertise R-bit in its router-LSA options [RFC5340] to prevent usage stub router links for transit traffic. Similarly, OSPFv2 routers supporting [RFC8770] can advertise the H-bit in the router-LSA options.

4. Management Considerations

Support of the Unreachable Link support capability SHOULD be configurable.

In some networks, the operator may still want links with maximum metric (0xffff) to be treated as reachable. For example, when the cost of links is automatically computed based on the inverse of the link's bandwidth and and there is a mix of low-speed and high-speed links, the computation may result in the maximum metric. In this case, OSPF routers supporting this specification can disable the Unreachable Link support capability and still treat links with maximum metric as reachable.

It is also RECOMMENDED that implementations supporting this document and auto-costing limit the maximum computed cost to MaxReachableLinkMetric (0xfffe).

5. YANG Data Model

YANG [RFC7950] is a data definition language used to define the contents of a conceptual data store that allows networked devices to be managed using NETCONF [RFC6241] or RESTCONF [RFC8040].

This section defines a YANG data model that can be used to configure and manage the usage of OSPF LSLinkInfinity for unreachable links as defined in this document, which augments the OSPF YANG data model [RFC9129] and the YANG Data Model for Routing Management [RFC8349].

5.1. Tree for the YANG Data Model

This document uses the graphical representation of data models per [RFC8340].

The following show the tree diagram of the module:

```
   augment /rt:routing/rt:control-plane-protocols
             /rt:control-plane-protocol/ospf:ospf:
     +--rw unreachable-link-advertisement
        +--rw enabled?   boolean
   augment /rt:routing/rt:control-plane-protocols
             /rt:control-plane-protocol/ospf:ospf/ospf:areas/ospf:area
             /ospf:database/ospf:area-scope-lsa-type
             /ospf:area-scope-lsas/ospf:area-scope-lsa/ospf:version
             /ospf:ospfv2/ospf:ospfv2/ospf:body/ospf:opaque
             /ospf:ri-opaque/ospf:router-capabilities-tlv:
     +--ro router-functional-capabilities
        +--ro functional-capabilities*   identityref
   augment /rt:routing/rt:control-plane-protocols
             /rt:control-plane-protocol/ospf:ospf/ospf:database
             /ospf:as-scope-lsa-type/ospf:as-scope-lsas
             /ospf:as-scope-lsa/ospf:version/ospf:ospfv2/ospf:ospfv2
             /ospf:body/ospf:opaque/ospf:ri-opaque
             /ospf:router-capabilities-tlv:
     +--ro router-functional-capabilities
        +--ro functional-capabilities*   identityref
   augment /rt:routing/rt:control-plane-protocols
             /rt:control-plane-protocol/ospf:ospf/ospf:database
             /ospf:as-scope-lsa-type/ospf:as-scope-lsas
             /ospf:as-scope-lsa/ospf:version/ospf:ospfv3/ospf:ospfv3
             /ospf:body/ospf:router-information
             /ospf:router-capabilities-tlv:
     +--ro router-functional-capabilities
        +--ro functional-capabilities*   identityref
   augment /rt:routing/rt:control-plane-protocols
             /rt:control-plane-protocol/ospf:ospf/ospf:areas/ospf:area
             /ospf:database/ospf:area-scope-lsa-type
             /ospf:area-scope-lsas/ospf:area-scope-lsa/ospf:version
             /ospf:ospfv3/ospf:ospfv3/ospf:body/ospf:router-information
             /ospf:router-capabilities-tlv:
     +--ro router-functional-capabilities
        +--ro functional-capabilities*   identityref
```

5.2. YANG Data Model for OSPF Advertising Unreachable Links

The following is the YANG module:

```
<CODE BEGINS> file "ietf-ospf-unreachable-links@2025-08-20.yang"
module ietf-ospf-unreachable-links {
  yang-version 1.1;
  namespace
    "urn:ietf:params:xml:ns:yang:ietf-ospf-unreachable-links";
  prefix ospf-unreach-link;
```

```
  import ietf-routing {
    prefix rt;
    reference
      "RFC 8349: A YANG Data Model for Routing
       Management (NMDA Version)";
  }
  import ietf-ospf {
    prefix ospf;
    reference
      "RFC 9129: YANG Data Model for the OSPF Protocol";
  }

  organization
    "IETF LSR - Link State Routing Working Group";
  contact
    "WG Web:   <https://datatracker.ietf.org/wg/lsr/>
     WG List:  <mailto:lsr@ietf.org>

     Author:   Yingzhen Qu
               <mailto:yqu@futurewei.com>
     Author:   Acee Lindem
               <mailto:acee.ietf@gmail.com>";
  description
    "This YANG module defines the configuration and operational
     state for Advertising Unreachable Links in OSPF as defined
     in RFC XXXX.

     Copyright (c) 2025 IETF Trust and the persons identified as
     authors of the code.  All rights reserved.

     Redistribution and use in source and binary forms, with or
     without modification, is permitted pursuant to, and subject to
     the license terms contained in, the Revised BSD License set
     forth in Section 4.c of the IETF Trust's Legal Provisions
     Relating to IETF Documents
     (https://trustee.ietf.org/license-info).

     This version of this YANG module is part of RFC XXXX;
     see the RFC itself for full legal notices.";
  reference
    "RFC XXXX";

  revision 2025-08-20 {
    description
      "Initial version";
    reference
      "RFC XXXX: Advertising Unreachable Links in OSPF";
  }
```

```
identity functional-capability {
  description
    "Base identity for router informational capabilities.";
}

identity unreachable-link {
  base ospf-unreach-link:functional-capability;
  description
    "When set, the router is capable of advertising unreachable
     links.";
}

grouping router-functional-capabilities {
  description
    "Grouping for OSPF router capabilities TLV types.";
  reference
    "RFC 7770: Extensions to OSPF for Advertising Optional
     Router Capabilities";
  container router-functional-capabilities {
    leaf-list functional-capabilities {
      type identityref {
        base functional-capability;
      }
      description
        "List of functional capabilities. This list will
         contain the identities for the functional
         capabilities supported by the router.";
    }
    description
      "OSPF Router Functional identity definitions.";
  }
}

augment "/rt:routing/rt:control-plane-protocols"
      + "/rt:control-plane-protocol/ospf:ospf" {
  when "../rt:type = 'ospf:ospfv2' or "
     + "../rt:type = 'ospf:ospfv3'" {
    description
      "This augments the OSPF routing protocol when used.";
  }
  description
    "This augments OSPF protocol with unreachable link
     advertisement.";
  container unreachable-link-advertisement {
    leaf enabled {
      type boolean;
      default "false";
      description
```

```
            "Enable advertisement of unreachable links.";
        }
        description
          "OSPF unreachable link advertisement configuration.";
      }
    }

    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/ospf:areas/"
          + "ospf:area/ospf:database/"
          + "ospf:area-scope-lsa-type/ospf:area-scope-lsas/"
          + "ospf:area-scope-lsa/ospf:version/ospf:ospfv2/"
          + "ospf:ospfv2/ospf:body/ospf:opaque/"
          + "ospf:ri-opaque/ospf:router-capabilities-tlv" {
      when "derived-from(/rt:routing/rt:control-plane-protocols/"
         + "rt:control-plane-protocol/rt:type, 'ospf:ospfv2')" {
        description
          "This augmentation is only valid for OSPFv2.";
      }
      description
        "OSPFv2 Opaque Area-Scoped Router-Information LSA Router
         Functional capabilities (RFC 7770).";
      uses router-functional-capabilities;
    }

    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/ospf:database/"
          + "ospf:as-scope-lsa-type/ospf:as-scope-lsas/"
          + "ospf:as-scope-lsa/ospf:version/ospf:ospfv2/"
          + "ospf:ospfv2/ospf:body/ospf:opaque/"
          + "ospf:ri-opaque/ospf:router-capabilities-tlv" {
      when "derived-from(/rt:routing/rt:control-plane-protocols/"
         + "rt:control-plane-protocol/rt:type, 'ospf:ospfv2')" {
        description
          "This augmentation is only valid for OSPFv2.";
      }
      description
        "OSPFv2 Opaque AS-Scoped Router-Information LSA Router
         Functional capabilities (RFC 7770).";
      uses router-functional-capabilities;
    }

    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/ospf:database/"
          + "ospf:as-scope-lsa-type/ospf:as-scope-lsas/"
```

```
          + "ospf:as-scope-lsa/ospf:version/ospf:ospfv3/"
          + "ospf:ospfv3/ospf:body/ospf:router-information/"
          + "ospf:router-capabilities-tlv" {
        when "derived-from(/rt:routing/rt:control-plane-protocols/"
           + "rt:control-plane-protocol/rt:type, 'ospf:ospfv3')" {
          description
            "This augmentation is only valid for OSPFv3.";
        }
        description
          "OSPFv3 Area-Scoped Router-Information LSA Router
           Functional capabilities (RFC 7770).";
        uses router-functional-capabilities;
      }

      augment "/rt:routing/"
            + "rt:control-plane-protocols/rt:control-plane-protocol/"
            + "ospf:ospf/ospf:areas/"
            + "ospf:area/ospf:database/"
            + "ospf:area-scope-lsa-type/ospf:area-scope-lsas/"
            + "ospf:area-scope-lsa/ospf:version/ospf:ospfv3/"
            + "ospf:ospfv3/ospf:body/ospf:router-information/"
            + "ospf:router-capabilities-tlv" {
        when "derived-from(/rt:routing/rt:control-plane-protocols/"
           + "rt:control-plane-protocol/rt:type, 'ospf:ospfv3')" {
          description
            "This augmentation is only valid for OSPFv3.";
        }
        description
          "OSPFv3 AS-Scoped Router-Information LSA Router
           Functional capabilities (RFC 7770).";
        uses router-functional-capabilities;
      }
    }
    <CODE ENDS>
```

6. Security Considerations

The document does not introduce any new security issues for the OSPF protocol. The security considerations for [RFC2328],[RFC5340], [RFC6987], and [RFC7770] are applicable to protocol extension.

The ietf-ospf-unreachable-links YANG module defines a data model that is designed to be accessed via YANG-based management protocols, such as NETCONF [RFC6241] and RESTCONF [RFC8040]. These YANG-based management protocols (1) have to use a secure transport layer (e.g., SSH [RFC4252], TLS [RFC8446], and QUIC [RFC9000]) and (2) have to use mutual authentication.

The NETCONF Access Control Model (NACM) [RFC8341] provides the means to restrict access for particular NETCONF or RESTCONF users to a pre-configured subset of all available NETCONF or RESTCONF protocol operations and content.

The following data nodes defined in the YANG module that are writable/creatable/deletable (i.e., config true, which is the default). The modifications to these data nodes without proper protection can have prevent interpreting the OSPF LSLinkInfinity metric as unreachable.

/ospf:ospf/ospf-unreach-link:unreachable-link-advertisement/ospf-unreach-link:enabled

Some of the readable data nodes in this YANG module may be considered sensitive or vulnerable in some network environments. Exposure of the OSPF link state database may be useful in mounting a Denial-of-Service (DoS) attacks. These are the readable data nodes:

/ospf:ospf/ospf-unreach-link:unreachable-link-advertisement/ospf-unreach-link:enabled

7. IANA Considerations

This document defines a new bit in the registry "OSPF Router Functional Capability Bits":

Bit Number	Capability Name	Reference
0(TBD)	Unreachable Link support	This document

Table 2

The IANA is requested to assign one new URI from the IETF XML registry ([RFC3688]). Authors are suggesting the following URI:

URI: urn:ietf:params:xml:ns:yang:ietf-ospf-unreachable-links
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace

This document also requests one new YANG module name in the YANG Module Names registry ([RFC6020]) with the following suggestion :

```
name: ietf-ospf-unreachable-links
namespace: urn:ietf:params:xml:ns:yang:ietf-ospf-unreachable-links
prefix: ospf-unreach-link
reference: RFC XXXX
```

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10. References

10.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <https://www.rfc-editor.org/info/rfc2119>.

[RFC2328] Moy, J., "OSPF Version 2", STD 54, RFC 2328, DOI 10.17487/RFC2328, April 1998, <https://www.rfc-editor.org/info/rfc2328>.

[RFC3688] Mealling, M., "The IETF XML Registry", BCP 81, RFC 3688, DOI 10.17487/RFC3688, January 2004, <https://www.rfc-editor.org/info/rfc3688>.

[RFC4915] Psenak, P., Mirtorabi, S., Roy, A., Nguyen, L., and P. Pillay-Esnault, "Multi-Topology (MT) Routing in OSPF", RFC 4915, DOI 10.17487/RFC4915, June 2007, <https://www.rfc-editor.org/info/rfc4915>.

[RFC6020] Bjorklund, M., Ed., "YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF)", RFC 6020, DOI 10.17487/RFC6020, October 2010, <https://www.rfc-editor.org/info/rfc6020>.

[RFC6241] Enns, R., Ed., Bjorklund, M., Ed., Schoenwaelder, J., Ed., and A. Bierman, Ed., "Network Configuration Protocol (NETCONF)", RFC 6241, DOI 10.17487/RFC6241, June 2011, <https://www.rfc-editor.org/info/rfc6241>.

[RFC7684] Psenak, P., Gredler, H., Shakir, R., Henderickx, W., Tantsura, J., and A. Lindem, "OSPFv2 Prefix/Link Attribute Advertisement", RFC 7684, DOI 10.17487/RFC7684, November 2015, <https://www.rfc-editor.org/info/rfc7684>.

[RFC7770] Lindem, A., Ed., Shen, N., Vasseur, JP., Aggarwal, R., and S. Shaffer, "Extensions to OSPF for Advertising Optional Router Capabilities", RFC 7770, DOI 10.17487/RFC7770, February 2016, <https://www.rfc-editor.org/info/rfc7770>.

[RFC7950] Bjorklund, M., Ed., "The YANG 1.1 Data Modeling Language", RFC 7950, DOI 10.17487/RFC7950, August 2016, <https://www.rfc-editor.org/info/rfc7950>.

[RFC8040] Bierman, A., Bjorklund, M., and K. Watsen, "RESTCONF Protocol", RFC 8040, DOI 10.17487/RFC8040, January 2017, <https://www.rfc-editor.org/info/rfc8040>.

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <https://www.rfc-editor.org/info/rfc8174>.

[RFC8341] Bierman, A. and M. Bjorklund, "Network Configuration Access Control Model", STD 91, RFC 8341, DOI 10.17487/RFC8341, March 2018, <https://www.rfc-editor.org/info/rfc8341>.

[RFC8349] Lhotka, L., Lindem, A., and Y. Qu, "A YANG Data Model for Routing Management (NMDA Version)", RFC 8349, DOI 10.17487/RFC8349, March 2018, <https://www.rfc-editor.org/info/rfc8349>.

[RFC8362] Lindem, A., Roy, A., Goethals, D., Reddy Vallem, V., and F. Baker, "OSPFv3 Link State Advertisement (LSA) Extensibility", RFC 8362, DOI 10.17487/RFC8362, April 2018, <https://www.rfc-editor.org/info/rfc8362>.

[RFC9129] Yeung, D., Qu, Y., Zhang, Z., Chen, I., and A. Lindem, "YANG Data Model for the OSPF Protocol", RFC 9129, DOI 10.17487/RFC9129, October 2022, <https://www.rfc-editor.org/info/rfc9129>.

10.2. Informative References

[RFC4252] Ylonen, T. and C. Lonvick, Ed., "The Secure Shell (SSH) Authentication Protocol", RFC 4252, DOI 10.17487/RFC4252, January 2006, <https://www.rfc-editor.org/info/rfc4252>.

[RFC5340] Coltun, R., Ferguson, D., Moy, J., and A. Lindem, "OSPF for IPv6", RFC 5340, DOI 10.17487/RFC5340, July 2008, <https://www.rfc-editor.org/info/rfc5340>.

[RFC6987] Retana, A., Nguyen, L., Zinin, A., White, R., and D. McPherson, "OSPF Stub Router Advertisement", RFC 6987, DOI 10.17487/RFC6987, September 2013, <https://www.rfc-editor.org/info/rfc6987>.

[RFC7308] Osborne, E., "Extended Administrative Groups in MPLS Traffic Engineering (MPLS-TE)", RFC 7308, DOI 10.17487/RFC7308, July 2014, <https://www.rfc-editor.org/info/rfc7308>.

[RFC8340] Bjorklund, M. and L. Berger, Ed., "YANG Tree Diagrams", BCP 215, RFC 8340, DOI 10.17487/RFC8340, March 2018, <https://www.rfc-editor.org/info/rfc8340>.

[RFC8446] Rescorla, E., "The Transport Layer Security (TLS) Protocol Version 1.3", RFC 8446, DOI 10.17487/RFC8446, August 2018, <https://www.rfc-editor.org/info/rfc8446>.

[RFC8770] Patel, K., Pillay-Esnault, P., Bhardwaj, M., and S. Bayraktar, "Host Router Support for OSPFv2", RFC 8770, DOI 10.17487/RFC8770, April 2020, <https://www.rfc-editor.org/info/rfc8770>.

[RFC9000] Iyengar, J., Ed. and M. Thomson, Ed., "QUIC: A UDP-Based Multiplexed and Secure Transport", RFC 9000, DOI 10.17487/RFC9000, May 2021, <https://www.rfc-editor.org/info/rfc9000>.

[RFC9350] Psenak, P., Ed., Hegde, S., Filsfils, C., Talaulikar, K., and A. Gulko, "IGP Flexible Algorithm", RFC 9350, DOI 10.17487/RFC9350, February 2023, <https://www.rfc-editor.org/info/rfc9350>.

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