LSR Working Group
Internet-Draft
Updates: 5443, 6987, 8770 (if approved)
Intended status: Standards Track
Expires: 15 September 2026

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14 March 2026

Advertising Unreachable Links in OSPF
draft-ietf-lsr-ospf-ls-link-infinity-25

Abstract

OSPF Router Link State Advertisements (LSAs) use fixed-format encodings that always include advertised links in the default SPF (Shortest Path First) computation. For non-default SPF computations, e.g., flexible algorithms as described in RFC 9350, advertised OSPF links are used in the default SPF computation even if this is not intended. 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. If all OSPF routers in an OSPF area support this functionality and have advertised the capability via an area-scoped OSPF Router-Information LSA, then links advertised with a metric of LSLinkInfinity are considered unreachable.

MaxReachableLinkMetric (0xfffe) is defined to provide backward compatible reachability in specifications that previously specified advertisement of MaxLinkMetric (0xffff). This document updates RFC 5443, RFC 6987, RFC 8379, and RFC 8770 with respect to the advertisement of MaxReachableLinkMetric (0xfffe) rather than MaxLinkMetric (0xffff).

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1. Introduction

OSPF Router Link State Advertisements (LSAs) use fixed-format encodings that always include advertised links in the default SPF (Shortest Path First) computation. For example, a link may be required for Traffic Engineering (TE) paths but not intended 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, refer to Section 3.2).

Stub Router Advertisement [RFC6987] defines MaxLinkMetric (0xffff) to indicate a router-LSA link should only be used for transit IP traffic as a last resort. When an OSPF router supports the Unreachable Link capability defined in this document, OSPF Stub Router links are advertised as MaxReachableLinkMetric (0xfffe) rather than MaxLinkMetric (0xffff). This document updates [RFC6987] and [RFC8770] with respect to the advertisement of MaxReachableLinkMetric rather than MaxLinkMetric.

Similarly, Label Distribution Protocol (LDP) IGP Synchronization [RFC5443] specifies OSPF advertisement of MaxLinkMetric (0xffff) to indicate that while the OSPF adjacency is in FULL state, LDP has not been synchronized between the two neighbors and transit traffic is discouraged. This document updates [RFC5443] with respect to the advertisement of MaxReachableLinkMetric rather than MaxLinkMetric.

Finally, OSPF Graceful Link Shutdown [RFC8379] specifies OSPF advertisement of MaxLinkMetric (0xffff) to indicate that the OSPF link will be taken out of service and usage transit traffic is discouraged. This document updates [RFC8379] with respect to the advertisement of MaxReachableLinkMetric rather than MaxLinkMetric.

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.

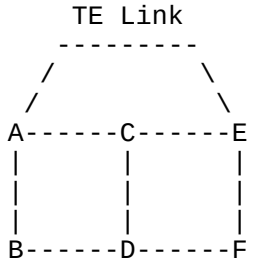

Figure 1: Network Topology

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.

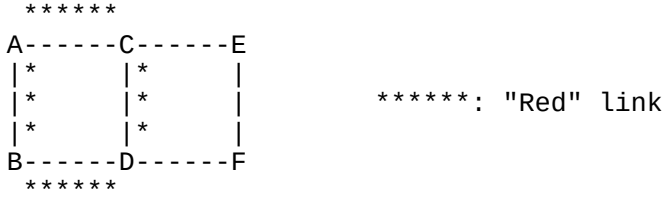

Figure 2: Network Topology

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 OSPF metric. OSPF will compute routes for Flex-Algorithm 128 using these links. The topology associated with Flex-Algorithm 128 is shown in Figure 3.

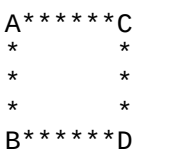

Figure 3: Topology of Flex-Algorithm 128

The "Red" links 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 OSPF 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.

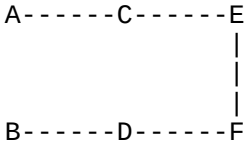

Figure 4: Base SPF Topology Excluding Unreachable Links

3. LSLinkInfinity-Based Solution

3.1. Unreachable Link Advertisement

This document specifies that if the OSPF 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 [RFC9350] and the base SPF as long as LSLinkInfinity is specified for the OSPF 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. Interpretation of LSLinkInfinity as unreachable is also applicable to Flex-Algorithm SPF computations [RFC9350] which use the OSPF link metric.

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

* The Router-LSA [RFC2328] [RFC5340]

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

3.2. Unreachable Link Backward Compatibility

Prior to this specification, OSPF treated links with an advertised metric of 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.

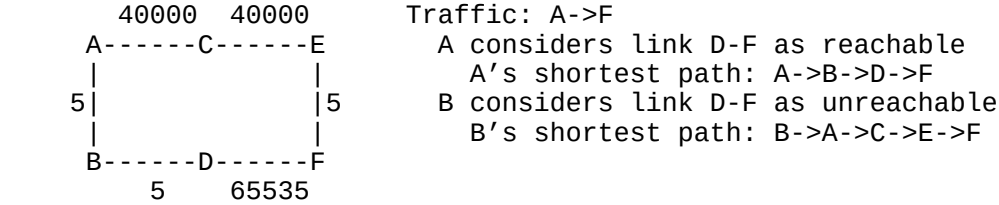

Figure 5: Inconsistent LSLinkInfinity Interpretation Causing Loops

To provide backward compatibility, this document specifies that routers supporting LSLinkInfinity for unreachable links support advertisement of an area-scoped Router Information (RI) LSA with a Router Functional Capabilities TLV [RFC7770] including the following Router Functional Capability Bit. The value of the bit is controlled by configuration as specified in Section 4.1.

Bit	Capabilities
TBD	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, i.e., all routers with Router-LSAs in the area Link State Database (LSDB), have advertised this capability in an OSPFv2 Router Information Opaque LSA or an OSPFv3 Router Information LSA. If all OSPF Routers in the area have advertised this capability, then links with an advertised metric of LSLinkInfinity MUST be treated as unreachable. When the number of routers in the area not supporting the Unreachable Link Capability changes to 0 or from 0 to greater than 0, all OSPF routers in the area MUST recalculate their routes.

In normal operation, it is possible that an area-scoped OSPF RI LSA will fail to reach all routers in an area in a timely manner. For example, if a new router not supporting the the Unreachable Link Capability joins an area that previously only had OSPF routers advertising support of the Unreachable Link Capability, then it may take some time for the OSPF RI LSA to propagate to all routers. While it is propagating, the routers in the area will gradually detect the presence of a router that does not support the capability and will revert to treating links with MaxLinkMetric as being reachable. During the propagation time, this inconsistency of MaxLinkMetric interpretation between OSPF routers can result in transient routing loops.

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 OSPF router supports the Unreachable Link capability defined in this document, the OSPF 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 OSPF router supports [RFC6987] and the Unreachable Link capability defined in this document, it MUST 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 OSPF 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. If there are any OSPF routers in the area that do not support the Unreachable Link capability, then all OSPF routers in the area will treat links advertised with a cost MaxLinkMetric as reachable (Section 3.2).

3.4. Label Distribution Protocol (LDP) IGP Synchronization Backward Compatibility

LDP IGP Synchronization [RFC5443] specifies OSPF advertisement of MaxLinkMetric (0xffff) to indicate that while the OSPF adjacency is in FULL state, LDP has not been synchronized between the two neighbors and transit IP traffic is discouraged. When an OSPF router supports the Unreachable Link capability defined in this document, the usage of OSPF MaxLinkMetric (0xffff) to discourage usage of the link until LDP is "fully operational" MUST be updated to MaxReachableLinkMetric (0xfffe). It is important to keep the link in the topology to allow IP traffic to use the link as a last resort in case of LDP packets between OSPF router loopbacks addresses or a network failure. This document updates [RFC5443] with respect to the advertisement of MaxReachableLinkMetric rather than MaxLinkMetric.

3.5. OSPF Graceful Link Shutdown Backward Compatibility

OSPF Graceful Link [RFC8379] specifies OSPF advertisement of MaxLinkMetric (0xffff) to indicate that the link is going to be taken down and transit traffic is discouraged. When an OSPF router supports the Unreachable Link capability defined in this document, the usage of OSPF MaxLinkMetric (0xffff) to discourage usage of a link prior to it being taken out of service MUST be updated to MaxReachableLinkMetric (0xfffe). It is important to keep the link in the topology to allow IP traffic to use the link as a last resort prior to planned shutdown. This document updates [RFC8379] with respect to the advertisement of MaxReachableLinkMetric rather than MaxLinkMetric.

4. Operational Considerations

4.1. Configuration Parameters

Support of the Unreachable Link capability MUST be configurable. The default MUST be to not advertise the capability, i.e., the functional capability in the area-scoped OSPF Router Information LSA is false.

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 there is a mix of low-speed and high-speed links, the computation may result in the maximum metric. Hence, implementations supporting this document and auto-costing MUST limit the maximum computed cost to MaxReachableLinkMetric (0xfffe). An example of auto-costing would be to automatically set the link metric to be inversely proportional to the link bandwidth (refer to the auto-cost feature in the ietf-ospf.yang [RFC9129]).

4.2. YANG Data Model

This section defines three YANG [RFC7950] modules. Module iana-ospf-functional-cap-bits defines the identities for OSPF Functional Capabilities as per the "OSPF Router Functional Capability Bits" IANA registry [IANA-OSPF-FC-Bits]. Module ietf-ospf-functional-capability and module ietf-ospf-unreachable-links 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].

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

4.2.1. Tree for OSPF Functional Capability

The following shows the tree diagram of the module for OSPF Functional Capability:

```
module: ietf-ospf-functional-capability
  augment /rt:routing/rt:control-plane-protocols
            /rt:control-plane-protocol/ospf:ospf/ospf:areas
            /ospf:area/ospf:interfaces/ospf:interface
            /ospf:database/ospf:link-scope-lsa-type
            /ospf:link-scope-lsas/ospf:link-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-capability*   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:ospfv2/ospf:ospfv2/ospf:body/ospf:opaque
            /ospf:ri-opaque/ospf:router-capabilities-tlv:
    +--ro router-functional-capabilities
       +--ro functional-capability*   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-capability*   identityref
     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/ospf:ospf/ospf:areas
               /ospf:area/ospf:interfaces/ospf:interface
               /ospf:database/ospf:link-scope-lsa-type
               /ospf:link-scope-lsas/ospf:link-scope-lsa/ospf:version
               /ospf:ospfv3/ospf:ospfv3/ospf:body
               /ospf:router-information/ospf:router-capabilities-tlv:
       +--ro router-functional-capabilities
          +--ro functional-capability*   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-capability*   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-capability*   identityref
```

4.2.2. Tree for OSPF Advertising Unreachable Links

The following shows the tree diagram of the module for OSPF Advertising Unreachable Links:

```
module: ietf-ospf-unreachable-links

  augment /rt:routing/rt:control-plane-protocols
            /rt:control-plane-protocol/ospf:ospf/ospf:areas
            /ospf:area:
    +--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:interfaces/ospf:interface:
    +--rw advertise-unreachable-link?   boolean
```

4.2.3. IANA Module for OSPF Functional Capability Bits

IANA has created a registry titled "OSPF Router Functional Capability Bits" under the "Open Shortest Path First (OSPF) Parameters" registry group to identify OSPF Router Functional Capabilities. Module iana-ospf-functional-cap-bits is an IANA-maintained module, which defines the identities for the OSPF Functional Capabilities as in the IANA "OSPF Router Functional Capability Bits" registry.

This module is maintained by IANA and will be updated if and when there is any change to the registry.

This document defines the initial version of the IANA-maintained YANG module for OSPF Router Functional Capabilities that mirrors the IANA "OSPF Router Functional Capability Bits" registry [IANA-OSPF-FC-Bits]. The latest version of this YANG module is available at TBD.

Note to the RFC Editor: Please remove this module in the version to be published as RFC.

This document defines the initial version of the IANA-maintained YANG module for OSPF Router Functional Capabilities that mirrors the IANA "OSPF Router Functional Capability Bits" registry [IANA-OSPF-FC-Bits].

<CODE BEGINS> file "iana-ospf-functional-cap-bits@2026-01-28.yang"

```
module iana-ospf-functional-cap-bits {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:"
          + "iana-ospf-functional-cap-bits";
  prefix iana-ospf-fc-bits;

  organization
    "Internet Assigned Numbers Authority (IANA)";
  contact
    "Internet Assigned Numbers Authority

     ICANN
     12025 Waterfront Drive, Suite 300
     Los Angeles, CA 90094-2536
     United States of America

     Tel:    +1 310 301 5800
     <mailto:iana@iana.org>";
  description
    "This YANG module defines the identities for OSPF Router
     Functional Capabilities.
```

```
        This YANG module is maintained by IANA and reflects the 'OSPF
        Router Functional Capability Bits' registry.

        Copyright (c) 2026 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).

        All revisions of IETF and IANA published modules can be found
        at the YANG Parameters registry group
        (https://www.iana.org/assignments/yang-parameters).

        This initial version of this YANG module is part of RFC XXXX
        (https://www.rfc-editor.org/info/rfcXXXX); see the RFC itself
        for full legal notices.

        The latest version of this YANG module is available at
        https://www.iana.org/assignments/yang-parameters.";

    revision 2026-01-28 {
      description
        "Initial version";
      reference
        "RFC XXXX: Advertising Unreachable Links in OSPF";
    }

    identity functional-capability {
      description
        "Base identity for OSPF Router Functional Capabilities. The
         functional capabilities are defined in IANA OSPF Router
         Functional Capability Bits registry.";
    }

    identity unreachable-link {
      base functional-capability;
      description
        "Indicates that the OSPF router is capable of advertising
         unreachable links.";
      reference
        "RFC XXXX: Advertising Unreachable Links in OSPF";
    }
  }
  <CODE ENDS>
```

4.2.4. YANG Module for OSPF Functional Capability

The following is the YANG module for OSPF Functional Capability:

```
<CODE BEGINS> file "ietf-ospf-functional-capability@2026-01-28.yang"
module ietf-ospf-functional-capability {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:"
          + "ietf-ospf-functional-capability";
  prefix ospf-fc;

  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";
  }
  import iana-ospf-functional-cap-bits {
    prefix iana-ospf-fc-bits;
    reference
      "RFC XXXX: Advertising Unreachable Links in OSPF";
  }

  organization
    "IETF Link State Routing (LSR) 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>
     Author:   Liyan Gong
               <mailto:gongliyan@chinamobile.com>
     Author:   Weiqiang Cheng
               <mailto:chengweiqiang@chinamobile.com>
     Author:   Changwang Lin
               <mailto:linchangwang.04414@h3c.com>
     Author:   Ran Chen
               <mailto:chen.ran@zte.com.cn>";
  description
    "This YANG module defines the operational state for
```

```
      Functional Capability in OSPF as defined in RFC 7770.

      Copyright (c) 2026 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
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      set forth in Section 4.c of the IETF Trust's Legal Provisions
      Relating to IETF Documents
      (https://trustee.ietf.org/license-info).

      All revisions of IETF and IANA published modules can be found
      at the YANG Parameters registry group
      (https://www.iana.org/assignments/yang-parameters).

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

    revision 2026-01-28 {
      description
        "Initial version";
      reference
        "RFC XXXX: Advertising Unreachable Links in OSPF";
    }

    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-capability {
          type identityref {
            base iana-ospf-fc-bits:functional-capability;
          }
          description
            "List of functional capabilities. This list
             contains 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/ospf:areas/ospf:area/"
          + "ospf:interfaces/ospf:interface/ospf:database/"
          + "ospf:link-scope-lsa-type/ospf:link-scope-lsas/"
          + "ospf:link-scope-lsa/ospf:version/ospf:ospfv2/"
          + "ospf:ospfv2/ospf:body/ospf:opaque/ospf:ri-opaque/"
          + "ospf:router-capabilities-tlv" {
      when "derived-from-or-self(/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 Link-Scoped Router-Information LSA Router
         Functional capabilities.";
      uses router-functional-capabilities;
      reference
        "RFC 7770: Extensions to OSPF for Advertising Optional
                   Router 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:ospfv2/"
          + "ospf:ospfv2/ospf:body/ospf:opaque/"
          + "ospf:ri-opaque/ospf:router-capabilities-tlv" {
      when "derived-from-or-self(/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.";
      uses router-functional-capabilities;
      reference
        "RFC 7770: Extensions to OSPF for Advertising Optional
                   Router 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-or-self(/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.";
      uses router-functional-capabilities;
      reference
        "RFC 7770: Extensions to OSPF for Advertising Optional
                   Router Capabilities";
    }

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

4.2.5. YANG Module for OSPF Advertising Unreachable Links

The following is the YANG module for OSPF Advertising Unreachable Links:

```
<CODE BEGINS> file "ietf-ospf-unreachable-links@2026-03-10.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 Link State Routing (LSR) Working Group";
  contact
    "WG Web:   <https://datatracker.ietf.org/wg/lsr/>
     WG List:  <mailto:lsr@ietf.org>

     Author:   Yingzhen Qu
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     Author:   Weiqiang Cheng
               <mailto:chengweiqiang@chinamobile.com>
     Author:   Changwang Lin
               <mailto:linchangwang.04414@h3c.com>
     Author:   Ran Chen
               <mailto:chen.ran@zte.com.cn>";
  description
    "This YANG module defines the configuration and operational
     state for Advertising Unreachable Links in OSPF as defined
     in RFC XXXX.

     Copyright (c) 2026 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).

        All revisions of IETF and IANA published modules can be found
        at the YANG Parameters registry group
        (https://www.iana.org/assignments/yang-parameters).

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

    revision 2026-03-10 {
      description
        "Initial version";
      reference
        "RFC XXXX: Advertising Unreachable Links in OSPF";
    }

    augment "/rt:routing/rt:control-plane-protocols/"
          + "rt:control-plane-protocol/ospf:ospf/"
          + "ospf:areas/ospf:area" {
      when "derived-from-or-self(../../../rt:type, 'ospf:ospfv2') or "
         + "derived-from-or-self(../../../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
            "Controls the interpretation of MaxLinkMetrc as
             unreachable and the advertisement of the unreachable
             link capability for the area. It is enabled when set
             to true and disabled when set to false.";
        }
        description
          "OSPF unreachable link advertisement parameters.";
      }
    }

    augment "/rt:routing/rt:control-plane-protocols/"
          + "rt:control-plane-protocol/ospf:ospf/"
          + "ospf:areas/ospf:area/ospf:interfaces/ospf:interface" {
      when "derived-from(/rt:routing/rt:control-plane-protocols/"
```

```
          + "rt:control-plane-protocol/rt:type, 'ospf:ospfv2') or "
          + "derived-from(/rt:routing/rt:control-plane-protocols/"
          + "rt:control-plane-protocol/rt:type, 'ospf:ospfv3')" {
        description
          "This augments the OSPF interfaces.";
      }
      leaf advertise-unreachable-link {
        type boolean;
        must "not(../advertise-unreachable-link = 'true' and "
           + "/rt:routing/rt:control-plane-protocols/"
           + "rt:control-plane-protocol/ospf:ospf/ospf:areas/"
           + "ospf:area/"
           + "ospf-unreach-link:unreachable-link-advertisement/"
           + "ospf-unreach-link:enabled = 'false')" {
          error-message "The interface cannot be advertised "
                      + "as unreachable (true) unless the "
                      + "unreachable-link-advertisement capability is "
                      + "enabled (true).";
          description
            "Ensures an interface isn't explicitly advertised as
             unreachable unless the OSPF instance level capability is
             enabled.";
        }
        default "false";
        description
          "Specifies that the link should be advertise with a metric
           of MaxLinkMetric (0xFFFF) in the default topology.";
      }
      description
        "Augment OSPF interfaces with anoption to advertise the link
         as unreachable.";
    }
  }
  <CODE ENDS>
```

5. Security Considerations

A compromised OSPF router could advertise changes to its Unreachable Link capability rapidly resulting in repeated route recalculations on routers in the area supporting this specification (Section 3.2). Hence, it is RECOMMENDED that routers supporting this specification also support the SPF back-off delay algorithm described in [RFC8405].

The security considerations for [RFC2328], [RFC5340], [RFC6987], and [RFC7770] are also applicable to this protocol extension.

The ietf-ospf-unreachable-links YANG module and the ietf-ospf-functional-capability YANG module each define 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 [I-D.ietf-tls-rfc8446bis], 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.

There are a number of data nodes defined in the ietf-ospf-unreachable-links YANG module that are writable/creatable/deletable (i.e., "config true", which is the default). All writable data nodes are likely to be sensitive or vulnerable in some network environments. Write operations (e.g., edit-config) and delete operations to these data nodes without proper protection or authentication can have a negative effect on network operations. The modification of these data nodes without proper protection can prevent interpretation of the OSPF LSLinkInfinity metric as unreachable or result in a link being advertised as unreachable.

```
/ospf:ospf/ospf:areas/ospf:area/ospf-unreach-link:unreachable-
link-advertisement/ospf-unreach-link:enabled

/ospf:ospf/ospf:areas/ospf:area/ospf:interfaces/ospf:interface/
ospf-unreach-link:advertise-unreachable-link
```

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

```
/ospf:ospf/ospf:areas/ospf:area/ospf-unreach-link:unreachable-
link-advertisement/ospf-unreach-link:enabled

/ospf:ospf/ospf:areas/ospf:area/ospf:interfaces/ospf:interface/
ospf-unreach-link:advertise-unreachable-link
```

6. IANA Considerations

6.1. Registering OSPF Router Functional Capability Bits

This document defines a new bit in the registry "OSPF Router Functional Capability Bits" (https://www.iana.org/assignments/ospf-parameters/ospf-parameters.xhtml#router-functional-capability):

Bit Number	Capability Name	Reference
TBD	Unreachable Link	This document

Table 2

6.2. Registering YANG Modules

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

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

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

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 three new YANG module names in the YANG Module Names registry ([RFC6020]) with the following suggestion :

```
   Name: iana-ospf-functional-cap-bits
   Maintained by IANA?  Y
   Namespace: urn:ietf:params:xml:ns:yang:iana-ospf-functional-cap-bits
   Prefix: iana-ospf-fc-bits
   Reference: RFC XXXX

   Name: ietf-ospf-functional-capability
   Maintained by IANA?  N
   Namespace: urn:ietf:params:xml:ns:yang:
              ietf-ospf-functional-capability
   Prefix: ospf-fc
   Reference: RFC XXXX

   Name: ietf-ospf-unreachable-links
   Maintained by IANA?  N
   Namespace: urn:ietf:params:xml:ns:yang:ietf-ospf-unreachable-links
   Prefix: ospf-unreach-link
   Reference: RFC XXXX
```

6.3. IANA Module for OSPF Functional Capability Bits

This document defines the initial version of the IANA-maintained "iana-ospf-functional-cap-bits" YANG module (Section 4.2). The most recent version of the YANG module is available from the "YANG Parameters" registry [IANA-YANG-Parameters].

IANA is requested to add this note to the registry:

> New values must not be directly added to the "iana-ospf-functional-cap-bits" YANG module. They must instead be added to the "OSPF Router Functional Capability Bits" registry in the "Open Shortest Path First (OSPF) Parameters" registry group [IANA-OSPF-FC-Bits].

When a value is added to the "OSPF Router Functional Capability Bits" registry, a new "identity" statement needs to be added to the "iana-ospf-functional-cap-bits" YANG module. The name of the "identity" is the lower-case name provided in the registry with all spaces replaced with “-“. The "identity" statement should have the following sub-statements defined:

"base":	Contains ’functional-capability’.
"description":	Contains the non-abbreviated OSPF capability bit name from the registry.
"reference":	Replicates the reference(s) from the registry with the title of the document(s) added.

IANA is requested to add this note to [IANA-OSPF-FC-Bits]:

| When this registry is modified, the YANG module "iana-ospf-
| functional-cap-bits" must be updated as defined in RFC XXXX.

7. Contributors

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8. Acknowledgments

Thanks to Yingzhen Qu for providing the YANG model.

Thanks to Dhruv Dhody for OPS Directorate review and comments.

Thanks to Gunter van de Velde for review and comments.

Thanks to Mohamed Boucadair for review and comments.

Thanks to Mike Bishop, Mahesh Jethanadani, and Ketan Taulaulikar for review and comments.

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