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## Extensions to OSPF for Advertising Prefix Administrative Tags

### Abstract

It is useful for routers in OSPFv2 and OSPFv3 routing domains to be able to associate tags with prefixes. Previously, OSPFv2 and OSPFv3 were relegated to a single tag and only for AS External and Not-So-Stubby-Area (NSSA) prefixes. With the flexible encodings provided by OSPFv2 Prefix/Link Attribute Advertisement and OSPFv3 Extended LSAs, multiple administrative tags may be advertised for all types of prefixes. These administrative tags can be used for many applications including route redistribution policy, selective prefix prioritization, selective IP Fast-ReRoute (IPFRR) prefix protection, and many others.

The ISIS protocol supports a similar mechanism that is described in RFC 5130.

### Status of This Memo

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## 1. Introduction

It is useful for routers in OSPFv2 [[RFC2328](#)] and OSPFv3 [[RFC5340](#)] routing domains to be able to associate tags with prefixes. Previously, OSPFv2 and OSPFv3 were relegated to a single tag and only for AS External and Not-So-Stubby-Area (NSSA) prefixes. With the flexible encodings provided by OSPFv2 Prefix/Link Attribute Advertisement ([[RFC7684](#)]) and OSPFv3 Extended LSA ([[RFC8362](#)]), multiple administrative tags may be advertised for all types of prefixes. These administrative tags can be used in many applications including (but not limited to):

1. Controlling which routes are redistributed into other protocols for re-advertisement.
2. Prioritizing selected prefixes for faster convergence and installation in the forwarding plane.
3. Identifying selected prefixes for Loop-Free Alternative (LFA) protection.

Throughout this document, OSPF is used when the text applies to both OSPFv2 and OSPFv3. OSPFv2 or OSPFv3 is used when the text is specific to one version of the OSPF protocol.

The definition of the 64-bit tag was considered but discarded given that there is no strong requirement or use case. The specification is included here for information.

The ISIS protocol supports a similar mechanism that is described in RFC 5130 [[RFC5130](#)].

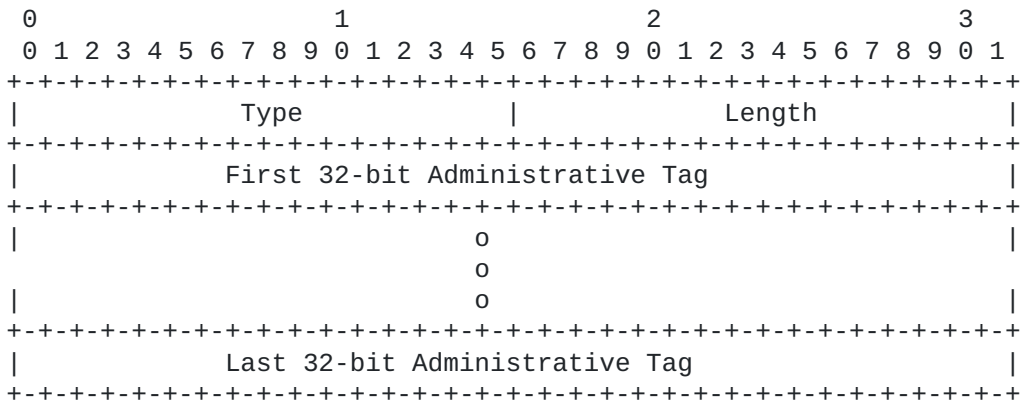
### 1.1. Requirements Language

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. 32-Bit Administrative Tag Sub-TLV

This document creates a new Administrative Tag Sub-TLV for OSPFv2 and OSPFv3. This Sub-TLV specifies one or more 32-bit unsigned integers that may be associated with an OSPF advertised prefix. The precise usage of these tags is beyond the scope of this document.

The format of the 32-bit Administrative Tag TLV is as follows:



- Type      A 16-bit field set to TBD.
- Length    A 16-bit field that indicates the length of the value portion in octets and MUST be a multiple of 4 octets dependent on the number of administrative tags advertised. At least one administrative tag must be advertised.
- Value     A variable length list of one or more administrative tags.

Figure 1: 32-bit Administrative Tag Sub-TLV

This sub-TLV will carry one or more 32-bit unsigned integer values that will be used as administrative tags.

### 3. Administrative Tag Applicability

The administrative tag TLV specified herein will be valid as a sub-TLV of the following TLVs specified in [RFC7684]:

1. Extended Prefix TLV advertised in the OSPFv2 Extended Prefix LSA

The administrative tag TLV specified herein will be valid as a sub-TLV of the following TLVs specified in [[RFC8362](#)]:

1. Inter-Area-Prefix TLV advertised in the E-Inter-Area-Prefix-LSA
2. Intra-Area-Prefix TLV advertised in the E-Intra-Area-Prefix-LSA.
3. External-Prefix TLV advertised in the E-AS-External-LSA and the E-NSSA-LSA

#### **4. Protocol Operation**

An OSPF router supporting this specification MUST be able to advertise and interpret at least one 32-bit tag for all type of prefixes. An OSPF router supporting this specification MAY be able to advertise and propagate multiple 32-bit tags. The maximum tags that an implementation supports is a local matter depending upon supported applications using prefix tags.

When tags are advertised for AS External or NSSA LSA prefixes, the existing tag in the OSPFv2 and OSPFv3 AS-External-LSA and NSSA-LSA encodings SHOULD be utilized for the first tag. This will facilitate backward compatibility with implementations that do not support this specification.

An OSPF router supporting this specification SHOULD propagate administrative tags when acting as an Area Border Router and originating summary advertisements into other areas (unless inhibited by local policy [Section 6](#)). Similarly, an OSPF router supporting this specification and acting as an ABR for a Not-So-Stubby Area (NSSA) SHOULD propagate tags when translating NSSA routes to AS External advertisements [[RFC3101](#)] (also subject to local policy [Section 6](#)). The number of tags supported MAY limit the number of tags that are propagated. When propagating multiple tags, the order of the the tags SHOULD be preserved.

For configured area ranges, NSSA ranges, and configured summarization of redistributed routes, tags from component routes SHOULD NOT be propagated to the summary. Implementations SHOULD provide a mechanism to configure multiple tags for area ranges, NSSA ranges, and redistributed route summaries.

##### **4.1. Equal-Cost Multipath Applicability**

When multiple LSAs contribute to an OSPF route, it is possible that these LSAs will all have different tags. In this situation, the OSPF router MUST associate the tags from one of the LSAs contributing a path and, if the implementation supports multiple tags, MAY associate tags for multiple contributing LSAs up to the maximum number of tags supported.

#### **5. BGP-LS Advertisement**

BGP-LS [[RFC7752](#)] introduced the support for advertising administrative tags associated with prefixes using the BGP-LS IGP Route Tag TLV (TLV 1153) that is used to carry the OSPF Administrative Tags specified in this document.

## 6. Management Considerations

Implementations MAY include configuration of policies to inhibit the advertisement of tags on and redistributed prefixes. Implementations MAY also include configuration of policies to filter the propagation of admin-tags between areas (both E-Inter-Area-Prefix-LSAs and translated E-AS-External-LSAs). However, the default behavior SHOULD be to advertise or propagate the lesser of all the tags associated with the prefix or the maximum number of tags supported by the implementation.

## 7. 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 prefix administrative tags defined in this document, which augments the OSPF YANG data model [[I-D.ietf-ospf-yang](#)] and the OSPFv3 Extended LSA YANG data model [[I-D.ietf-lsr-ospfv3-extended-lsa-yang](#)].

The following show the tree diagram of the module:

```

module: ietf-ospf-admin-tags

augment /rt:routing/rt:control-plane-protocols
  /rt:control-plane-protocol/ospf:ospf/ospf:areas/ospf:area
  /ospf:ranges/ospf:range:
  +-rw admin-tags
    +-rw tags* uint32
augment /rt:routing/rt:control-plane-protocols
  /rt:control-plane-protocol/ospf:ospf/ospf:areas/ospf:area
  /ospf:interfaces/ospf:interface:
  +-rw admin-tags
    +-rw tags* [tag]
    +-rw tag uint32
    +-rw advertise-prefixes* [prefix]
    +-rw prefix inet:ip-prefix
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:extended-prefix-opaque
  /ospf:extended-prefix-tlv:
  +-ro perfix-admin-tag-sub-tlvs
  +-ro admin-tag-sub-tlv* []
  +-ro admin-tags* uint32
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:extended-prefix-opaque
  /ospf:extended-prefix-tlv:
  +-ro perfix-admin-tag-sub-tlvs
  +-ro admin-tag-sub-tlv* []
  +-ro admin-tags* uint32
vv 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:extended-prefix-opaque/ospf:extended-prefix-tlv:
  +-ro perfix-admin-tag-sub-tlvs
  +-ro admin-tag-sub-tlv* []
  +-ro admin-tags* uint32
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/ospfv3-e-lsa:e-inter-area-prefix
  /ospfv3-e-lsa:e-inter-prefix-tlvs
  /ospfv3-e-lsa:inter-prefix-tlv:
  +-ro perfix-admin-tag-sub-tlvs
  +-ro admin-tag-sub-tlv* []
  +-ro admin-tags* uint32
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/ospfv3-e-lsa:e-intra-area-prefix
  /ospfv3-e-lsa:e-intra-prefix-tlvs

```

```
    /ospfv3-e-lsa:intra-prefix-tlv:
+--ro prefix-admin-tag-sub-tlvs
  +--ro admin-tag-sub-tlv* []
  +--ro admin-tags*   uint32
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
  /ospfv3-e-lsa:e-as-external/ospfv3-e-lsa:e-external-tlvs
  /ospfv3-e-lsa:external-prefix-tlv:
+--ro prefix-admin-tag-sub-tlvs
  +--ro admin-tag-sub-tlv* []
  +--ro admin-tags*   uint32
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
  /ospfv3-e-lsa:e-nssa/ospfv3-e-lsa:e-external-tlvs
  /ospfv3-e-lsa:external-prefix-tlv:
+--ro prefix-admin-tag-sub-tlvs
  +--ro admin-tag-sub-tlv* []
  +--ro admin-tags*   uint32
```

The following is the YANG module:



```
<CODE BEGINS> file "ietf-ospf-admin-tags@2022-10-11.yang"

module ietf-ospf-admin-tags {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-ospf-admin-tags";
  prefix ospf-admin-tags;

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

  import ietf-ospf {
    prefix ospf;
    reference "RFC xxxx: YANG Data Model for OSPF Protocol.";
  }

  import ietf-inet-types {
    prefix "inet";
    reference "RFC 6991: Common YANG Data Types";
  }

  import ietf-ospfv3-extended-lsa {
    prefix "ospfv3-e-lsa";
    reference "RFC xxxx: YANG Model for OSPFv3 Extended LSAs.";
  }

  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:yingzhen.qu@futurewei.com>
    Author: Acee Lindem
            <mailto:acee@cisco.com>
    Author: Peter Psenak
            <mailto:ppsenak@cisco.com>";

  description
    "This YANG module defines the configuration
    and operational state for OSPF administrative tags.

    This YANG model conforms to the Network Management
    Datastore Architecture (NMDA) as described in RFC 8342.

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```

(<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.

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 (RFC 2119) (RFC 8174) when, and only when, they appear in all capitals, as shown here.";

```
reference "RFC XXXX";

revision 2022-10-11 {
  description
    "Initial revision.";
  reference
    "RFC XXXX: A YANG Data Model for OSPFv2 Administrative Tags.";
}

grouping prefix-admin-tag-sub-tlvs {
  description "Prefix Administrative Tag sub-TLVs.";

  container perfix-admin-tag-sub-tlvs{
    description "Prefix admin tag sub-TLV.";
    list admin-tag-sub-tlv {
      description "Prefix admin tag sub-TLV.";
      leaf-list admin-tags {
        type uint32;
        description "32-bit administrative tag.";
      }
    }
  }
}

/* Configuration */
augment "/rt:routing/rt:control-plane-protocols/"
  + "rt:control-plane-protocol/ospf:ospf/"
  + "ospf:areas/ospf:area/ospf:ranges/ospf:range" {
  when "derived-from-or-self(..../..../..../..../"
    + "rt:type, 'ospf:ospf')" {
    description
      "This augments the OSPF routing protocol area range
      configuration.";
  }
  description
    "This augments the OSPF protocol area range configuration
    with Administrative Tags. The configured tags will be
    advertised with summary prefix when it is active.";

  container admin-tags {
    when "../ospf:advertise = 'true'";
    leaf-list tags {
      type uint32;
      description
        "32-bit administrative tags.";
    }
  }
  description
```

```

    "OSPF prefix administrative tags.";
}
}

augment "/rt:routing/rt:control-plane-protocols/"
+ "rt:control-plane-protocol/ospf:ospf/"
+ "ospf:areas/ospf:area/ospf:interfaces/ospf:interface" {
when "derived-from-or-self(..../..../..../..../"
+ "rt:type, 'ospf:ospf')" {
description
    "This augments the OSPF routing protocol interface
    configuration.";
}
description
    "This augments the OSPF protocol interface configuration
    with Administrative Tags. The configured tags will be
    advertised with local prefixes configured for the interface.";

container admin-tags {
list tags {
key "tag";
leaf tag {
type uint32;
description
    "32-bit administrative tag.";
}
list advertise-prefixes {
key "prefix";
leaf prefix {
type inet:ip-prefix;
description
    "IPv4 or IPv6 prefix";
}
description
    "By default, the tag advertised will be advertised
    for all prefixes associated with the interface.
    If advertise-prefixes is specified, the tag is
    only applied to interfaces prefixes in the list";
}
description
    "List of administrative tags that are to be advertised
    with prefixes associated with the interfaces. Optionally,
    tag advertisement may be restricted to specific
    prefixes.";
}
description
    "OSPF prefix administrative tags.";
}
}

/* Database */
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/"

```







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:areas/ospf:area/ospf:interfaces/ospf:interface/  
admin-tags
```

```
/ospf:ospf/ospf:areas/ospf:area/ospf:ranges/ospf:range/admin-tags
```

```
/prefix-admin-tag-sub-tlvs
```

## 9. IANA Considerations

The following values should be allocated from the OSPF Extended Prefix TLV Sub-TLV Registry [[RFC7684](#)]:

\*TBD - 32-bit Administrative Tag TLV

The following values should be allocated from the OSPFv3 Extended-LSA Sub-TLV Registry [[RFC8362](#)]:

\*TBD - 32-bit Administrative Tag TLV

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-admin-tags  
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-admin-tags  
namespace: urn:ietf:params:xml:ns:yang:ietf-ospf-admin-tags  
prefix: ospf-admin-tags  
reference: RFC XXXX
```

## 10. Acknowledgments

The authors of RFC 5130 are acknowledged since this document draws upon both the ISIS specification and deployment experience.

Thanks to Donnie Savage for his comments and questions.

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The RFC text was produced using Marshall Rose's xml2rfc tool.

## 11. 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>>.
- [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>>.
- [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>>.
- [RFC6242] Wasserman, M., "Using the NETCONF Protocol over Secure Shell (SSH)", RFC 6242, DOI 10.17487/RFC6242, June 2011, <<https://www.rfc-editor.org/info/rfc6242>>.
- [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>>.
- [RFC7752] Gredler, H., Ed., Medved, J., Previdi, S., Farrel, A., and S. Ray, "North-Bound Distribution of Link-State and Traffic Engineering (TE) Information Using BGP", RFC 7752, DOI 10.17487/RFC7752, March 2016, <<https://www.rfc-editor.org/info/rfc7752>>.
- [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>>.

[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>>.

[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>>.

[I-D.ietf-ospf-yang] Yeung, D. M., Qu, Y., Zhang, Z. J., Chen, I., and A. Lindem, "YANG Data Model for the OSPF Protocol", Work in Progress, Internet-Draft, draft-ietf-ospf-yang-29, 17 October 2019, <<https://www.ietf.org/archive/id/draft-ietf-ospf-yang-29.txt>>.

[I-D.ietf-lsr-ospfv3-extended-lsa-yang] Lindem, A., Palani, S., and Y. Qu, "YANG Model for OSPFv3 Extended LSAs", Work in Progress, Internet-Draft, draft-ietf-lsr-ospfv3-extended-lsa-yang-12, 30 August 2022, <<https://www.ietf.org/archive/id/draft-ietf-lsr-ospfv3-extended-lsa-yang-12.txt>>.

## 12. Informative References

[RFC3101] Murphy, P., "The OSPF Not-So-Stubby Area (NSSA) Option", RFC 3101, DOI 10.17487/RFC3101, January 2003, <<https://www.rfc-editor.org/info/rfc3101>>.

[RFC4271] Rekhter, Y., Ed., Li, T., Ed., and S. Hares, Ed., "A Border Gateway Protocol 4 (BGP-4)", RFC 4271, DOI 10.17487/RFC4271, January 2006, <<https://www.rfc-editor.org/info/rfc4271>>.

[RFC5130] Previdi, S., Shand, M., Ed., and C. Martin, "A Policy Control Mechanism in IS-IS Using Administrative Tags", RFC 5130, DOI 10.17487/RFC5130, February 2008, <<https://www.rfc-editor.org/info/rfc5130>>.

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