Network Working Group
Request for Comments: 4750
Obsoletes: 1850
Category: Standards Track

D. Joyal, Ed.
Nortel
P. Galecki, Ed.
Airvana
S. Giacalone, Ed.
CSFB
Original Authors:
R. Coltun
Touch Acoustra
F. Baker
Cisco Systems
December 2006

OSPF Version 2 Management Information Base

Status of This Memo

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Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in TCP/IP-based internets. In particular, it defines objects for managing version 2 of the Open Shortest Path First Routing Protocol. Version 2 of the OSPF protocol is specific to the IPv4 address family. Version 3 of the OSPF protocol is specific to the IPv6 address family.

This memo obsoletes RFC 1850; however, it is designed to be backwards compatible. The functional differences between this memo and RFC 1850 are explained in Appendix B.

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1. Overview

1.1. The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 [RFC3410].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIv2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

1.2. Conceptual Row Creation

For the benefit of row-creation in "conceptual" tables, DEFVAL (Default Value) clauses are included in the definitions in section 3, suggesting values that an agent should use for instances of variables that need to be created due to a Set-Request, but that are not specified in the Set-Request. DEFVAL clauses have not been specified for some objects that are read-only, implying that they are zeroed upon row creation. These objects are of the SYNTAX Counter32 or Gauge32.

For those objects not having a DEFVAL clause, both management stations and agents should heed the Robustness Principle of the Internet (see [RFC791]):

"be liberal in what you accept, conservative in what you send"

Therefore, management stations should include as many of these columnar objects as possible (e.g., all read-write objects) in a Set-Request when creating a conceptual row. Agents should accept a Set-Request with as few of these columnar objects as they need (e.g., the minimum contents of a "row-creating" SET consists of those objects for which, as they cannot be intuited, no default is specified).

1.3. Default Configuration

OSPF is a powerful routing protocol, equipped with features to handle virtually any configuration requirement that might reasonably be found within an Autonomous System (AS). With this power comes a fair degree of complexity, which the sheer number of objects in the MIB will attest to. Care has therefore been taken, in constructing this MIB, to define default values for virtually every object, to minimize the amount of parameterization required in the typical case. That default configuration is as follows:

Given the following assumptions:

- IP has already been configured.

- The ifTable has already been configured.

- ifSpeed is estimated by the interface drivers.

- The OSPF process automatically discovers all IP interfaces and creates corresponding OSPF interfaces.

- The OSPF process automatically creates the areas required for the interfaces.

The simplest configuration of an OSPF process requires the following:

- The OSPF process be enabled.

This can be accomplished with a single SET:

```
ospfAdminStat := enabled.
```

The configured system will have the following attributes:

- The RouterID will be one of the IP addresses of the device.

- The device will be neither an Area Border Router nor an Autonomous System Border Router.

- Every IP interface, with or without an address, will be an OSPF interface.

- The AreaID of each interface will be 0.0.0.0, the backbone.

- Authentication will be disabled.

- All broadcast and point-to-point interfaces will be operational. Non-broadcast multi-access (NBMA) interfaces require the configuration of at least one neighbor.

- Timers on all direct interfaces will be:

```
Hello Interval:        10 seconds
Dead Timeout:          40 Seconds
Retransmission:         5 Seconds
Transit Delay:          1 Second
Poll Interval:        120 Seconds
```

- No direct links to hosts will be configured.

- No addresses will be summarized.

- Metrics, being a measure of bit duration, are unambiguous and intelligent.

- No virtual links will be configured.

1.4. OSPF Counters

This MIB defines several counters, namely:

- ospfOriginateNewLsas, ospfRxNewLsas in the ospfGeneralGroup
- ospfSpfRuns, ospfAreaNssaTranslatorEvents in the ospfAreaTable
- ospfIfEvents in the ospfIfTable
- ospfVirtIfEvents in the ospfVirtIfTable
- ospfNbrEvents in the ospfNbrTable
- ospfVirtNbrEvents in the ospfVirtNbrTable

As a best practice, a management entity, when reading these counters, should use the discontinuity object, ospfDiscontinuityTime, to determine if an event that would invalidate the management entity understanding of the counters has occurred. A restart of the OSPF routing process is a possible example of a discontinuity event.

1.5. Multiple OSPF Instances

SNMPv3 supports "Contexts" that can be used to implement MIB views on multiple OSPF instances on the same system. See [RFC3411] or its successors for details.

1.6. Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

2. Structure of This MIB

This MIB is composed of the following sections:

- General Variables
- Area Data Structure
- Area Stub Metric Table
- Link State Database (LSDB)
- Address Range Table
- Host Table
- Interface Table
- Interface Metric Table
- Virtual Interface Table
- Neighbor Table
- Virtual Neighbor Table
- External Link State Database
- Aggregate Range Table
- Local Link State Database
- AS-scope Link State Database

It supports the base OSPFv2 specification [RFC2328] and extensions to OSPFv2 such as [RFC1765], [RFC1793], [RFC2370], [RFC3101] and [RFC3623].

There exists a separate MIB for notifications ("traps"), which is entirely optional.

2.1. The Purposes of the Sections in This MIB

2.1.1. General Variables

The general variables describe (as it may seem from the name) variables that are global to the OSPF Process.

2.1.2. Area Data Structure and Area Stub Metric Table

The Area Data Structure describes all of the OSPF Areas that the router participates in. The Area Table includes data for Not-So-Stubby-Area (NSSA) translation.

The Area Stub Metric Table describes the metrics advertised into a stub area by the default router(s).

2.1.3. Link State Database and External Link State Database

The link state database is provided primarily to provide detailed information for network debugging.

2.1.4. Address Table and Host Tables

The Address Range Table and Host Table are provided to view configured Network Summary and host route information.

2.1.5. Interface and Interface Metric Tables

The Interface Table and the Interface Metric Table together describe the various IP interfaces to OSPF. The metrics are placed in separate tables in order to simplify dealing with multiple types of service. The Interface table includes link-local (Opaque type-9) link state advertisement (LSA) statistics.

2.1.6. Virtual Interface Table

The Virtual Interface Table describes virtual links to the OSPF Process, similarly to the (non-virtual) Interface Tables. This Table includes link-local (Opaque type-9) LSA statistics.

2.1.7. Neighbor and Virtual Neighbor Tables

The Neighbor Table and the Virtual Neighbor Table describe the neighbors to the OSPF Process.

2.1.8. Local Link State Database Table and Virtual Local Link State Database Table

The Local Link State Database Table and Virtual Local Link State Database Table are identical to the OSPF LSDB Table in format, but contain only link-local (Opaque type-9) link state advertisements for non-virtual and virtual links.

2.1.9. AS-scope Link State Database Table

The AS-scope Link State Database Table is identical to the OSPF LSDB Table in format, but contains only AS-scoped link state advertisements.

2.1.10. Area LSA Count Table

The table, which maintains number of link state advertisements on the per-area, per-LSA-type basis.

3. OSPF MIB Module

```
OSPF-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE, Counter32, Gauge32,
    Integer32, Unsigned32, IpAddress, mib-2
                FROM SNMPv2-SMI
    TEXTUAL-CONVENTION, TruthValue, RowStatus, TimeStamp
                FROM SNMPv2-TC
    MODULE-COMPLIANCE, OBJECT-GROUP
                FROM SNMPv2-CONF
    InterfaceIndexOrZero
                FROM IF-MIB;

ospf MODULE-IDENTITY
       LAST-UPDATED "200611100000Z" -- November 10, 2006 00:00:00 EST
       ORGANIZATION "IETF OSPF Working Group"
       CONTACT-INFO
       "WG E-Mail: ospf@ietf.org

        WG Chairs: acee@cisco.com
                   rohit@gmail.com

        Editors:   Dan Joyal
                   Nortel
                   600 Technology Park Drive
                   Billerica, MA  01821
                   djoyal@nortel.com

                   Piotr Galecki
                   Airvana
                   19 Alpha Road
                   Chelmsford, MA 01824
                   pgalecki@airvana.com

                   Spencer Giacalone
                   CSFB
                   Eleven Madison Ave
                   New York, NY 10010-3629
                   spencer.giacalone@gmail.com"

       DESCRIPTION
          "The MIB module to describe the OSPF Version 2
          Protocol.  Note that some objects in this MIB
          module may pose a significant security risk.
          Refer to the Security Considerations section
          in RFC 4750 for more information.
```

```
          Copyright (C) The IETF Trust (2006).
          This version of this MIB module is part of
          RFC 4750;  see the RFC itself for full legal
          notices."

       REVISION "200611100000Z" -- November 10, 2006 09:00:00 EST
       DESCRIPTION
         "Updated for latest changes to OSPF Version 2:
          - updated the General Group with the new
            ospfRFC1583Compatibility, ospfReferenceBandwidth
            and ospfDiscontinuityTime objects
          - added graceful-restart-related objects
          - added stub-router-related objects
          - updated the Area Table with NSSA-related objects
          - added ospfAreaAggregateExtRouteTag object
          - added Opaque LSA-related objects
          - updates to the Compliances and Security sections
          - added area LSA counter table
          - added section describing translation of notification
            parameters between SNMP versions
          - added ospfComplianceObsolete to contain obsolete
            object groups
          - deprecated ospfExtLsdbTable
          See Appendix B of RFC 4750 for more details.

          This version published as part of RFC 4750"

       REVISION "199501201225Z" -- Fri Jan 20 12:25:50 PST 1995
       DESCRIPTION
          "The initial SMIv2 revision of this MIB module, published
          in RFC 1850."
       ::= { mib-2 14 }

AreaID ::= TEXTUAL-CONVENTION
       STATUS       current
       DESCRIPTION
          "An OSPF Area Identifier.
           Note that the Area ID, in OSPF, has the same format
           as an IP address, but has the function of defining
           a summarization point for link state advertisements."
       SYNTAX       IpAddress

RouterID ::= TEXTUAL-CONVENTION
       STATUS       current
       DESCRIPTION
          "A OSPF Router Identifier.
           Note that the Router ID, in OSPF, has the same format
           as an IP address, but identifies the router independent
```

```
            of its IP address."
        SYNTAX       IpAddress

Metric ::= TEXTUAL-CONVENTION
        DISPLAY-HINT "d-0"
        STATUS       current
        DESCRIPTION
           "The OSPF internal metric.
            Note that the OSPF metric is defined as an unsigned value
            in the range."
        SYNTAX       Integer32 (0..'FFFF'h)

BigMetric ::= TEXTUAL-CONVENTION
        DISPLAY-HINT "d-0"
        STATUS       current
        DESCRIPTION
           "The OSPF external metric."
        SYNTAX       Integer32 (0..'FFFFFF'h)

Status ::= TEXTUAL-CONVENTION
        STATUS       current
        DESCRIPTION
           "An indication of the operability of an OSPF
           function or feature.  For example, the status
           of an interface: 'enabled' indicates that
           it is willing to communicate with other OSPF routers,
           and 'disabled' indicates that it is not."
        SYNTAX       INTEGER { enabled (1), disabled (2) }

PositiveInteger ::= TEXTUAL-CONVENTION
        DISPLAY-HINT "d-0"
        STATUS       current
        DESCRIPTION
           "A positive integer.  Values in excess are precluded as
           unnecessary and prone to interoperability issues."
        SYNTAX       Integer32 (0..'7FFFFFFF'h)

HelloRange ::= TEXTUAL-CONVENTION
        DISPLAY-HINT "d-0"
        STATUS       current
        DESCRIPTION
           "The range of intervals in seconds on which Hello messages
           are exchanged."
        SYNTAX       Integer32 (1..'FFFF'h)

UpToMaxAge ::= TEXTUAL-CONVENTION
        DISPLAY-HINT "d-0"
        STATUS       current
```

```
        DESCRIPTION
           "The values in seconds that one might find or configure
           for variables bounded by the maximum age of an LSA."
        SYNTAX       Integer32 (0..3600)

DesignatedRouterPriority ::= TEXTUAL-CONVENTION
        DISPLAY-HINT "d-0"
        STATUS       current
        DESCRIPTION
           "The range of values defined for the priority of a system
           for becoming the designated router."
        SYNTAX       Integer32 (0..'FF'h)

TOSType ::= TEXTUAL-CONVENTION
        DISPLAY-HINT "d-0"
        STATUS      current
        DESCRIPTION
         "Type of Service (TOS) is defined as a mapping to the IP
         Type of Service Flags as defined in the IP Forwarding
         Table MIB

             +-----+-----+-----+-----+-----+-----+-----+-----+
             |                 |                       |     |
             |   PRECEDENCE    |    TYPE OF SERVICE    |  0  |
             |                 |                       |     |
             +-----+-----+-----+-----+-----+-----+-----+-----+

                   IP TOS                  IP TOS
               Field     Policy        Field     Policy

               Contents    Code        Contents    Code
               0 0 0 0  ==>   0        0 0 0 1  ==>   2
               0 0 1 0  ==>   4        0 0 1 1  ==>   6
               0 1 0 0  ==>   8        0 1 0 1  ==>  10
               0 1 1 0  ==>  12        0 1 1 1  ==>  14
               1 0 0 0  ==>  16        1 0 0 1  ==>  18
               1 0 1 0  ==>  20        1 0 1 1  ==>  22
               1 1 0 0  ==>  24        1 1 0 1  ==>  26
               1 1 1 0  ==>  28        1 1 1 1  ==>  30

          The remaining values are left for future definition."
            SYNTAX       Integer32 (0..30)

OspfAuthenticationType ::= TEXTUAL-CONVENTION
        STATUS       current
        DESCRIPTION
           "The authentication type."
        SYNTAX       INTEGER {
```

```
                        none (0),
                        simplePassword (1),
                        md5 (2)
                        -- reserved for specification by IANA (> 2)
                     }

--  OSPF General Variables

--      Note: These parameters apply globally to the Router's
--      OSPF Process.

ospfGeneralGroup OBJECT IDENTIFIER ::= { ospf 1 }

  ospfRouterId OBJECT-TYPE
       SYNTAX       RouterID
       MAX-ACCESS   read-write
       STATUS       current
       DESCRIPTION
          "A 32-bit integer uniquely identifying the
          router in the Autonomous System.
          By convention, to ensure uniqueness, this
          should default to the value of one of the
          router's IP interface addresses.

          This object is persistent and when written
          the entity SHOULD save the change to non-volatile storage."
       REFERENCE
          "OSPF Version 2, C.1 Global parameters"
       ::= { ospfGeneralGroup 1 }

  ospfAdminStat OBJECT-TYPE
       SYNTAX       Status
       MAX-ACCESS   read-write
       STATUS       current
       DESCRIPTION
          "The administrative status of OSPF in the
          router.  The value 'enabled' denotes that the
          OSPF Process is active on at least one interface;
          'disabled' disables it on all interfaces.

          This object is persistent and when written
          the entity SHOULD save the change to non-volatile storage."
       ::= { ospfGeneralGroup 2 }

  ospfVersionNumber OBJECT-TYPE
       SYNTAX       INTEGER { version2 (2) }
       MAX-ACCESS   read-only
       STATUS       current
```

```
      DESCRIPTION
         "The current version number of the OSPF protocol is 2."
      REFERENCE
         "OSPF Version 2, Title"
      ::= { ospfGeneralGroup 3 }

  ospfAreaBdrRtrStatus OBJECT-TYPE
      SYNTAX       TruthValue
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "A flag to note whether this router is an Area
         Border Router."
      REFERENCE
         "OSPF Version 2, Section 3 Splitting the AS into
         Areas"
      ::= { ospfGeneralGroup 4 }

  ospfASBdrRtrStatus OBJECT-TYPE
      SYNTAX       TruthValue
      MAX-ACCESS   read-write
      STATUS       current
      DESCRIPTION
         "A flag to note whether this router is configured as
          an Autonomous System Border Router.

          This object is persistent and when written the
          entity SHOULD save the change to non-volatile storage."
      REFERENCE
         "OSPF Version 2, Section 3.3 Classification of
         routers"
      ::= { ospfGeneralGroup 5 }

  ospfExternLsaCount OBJECT-TYPE
       SYNTAX       Gauge32
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "The number of external (LS type-5) link state
          advertisements in the link state database."
       REFERENCE
          "OSPF Version 2, Appendix A.4.5 AS external link
          advertisements"
       ::= { ospfGeneralGroup 6 }

  ospfExternLsaCksumSum OBJECT-TYPE
       SYNTAX       Integer32
       MAX-ACCESS   read-only
```

```
        STATUS       current
        DESCRIPTION
           "The 32-bit sum of the LS checksums of
           the external link state advertisements
           contained in the link state database.  This sum
           can be used to determine if there has been a
           change in a router's link state database and
           to compare the link state database of two
           routers.  The value should be treated as unsigned
           when comparing two sums of checksums."
        ::= { ospfGeneralGroup 7 }

  ospfTOSSupport OBJECT-TYPE
       SYNTAX       TruthValue
       MAX-ACCESS   read-write
       STATUS       current
       DESCRIPTION
          "The router's support for type-of-service routing.

           This object is persistent and when written
           the entity SHOULD save the change to non-volatile
           storage."
       REFERENCE
          "OSPF Version 2, Appendix F.1.2 Optional TOS
          support"
       ::= { ospfGeneralGroup 8 }

   ospfOriginateNewLsas OBJECT-TYPE
       SYNTAX       Counter32
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "The number of new link state advertisements
          that have been originated.  This number is
          incremented each time the router originates a new
          LSA.

          Discontinuities in the value of this counter can
          occur at re-initialization of the management system,
          and at other times as indicated by the value of
          ospfDiscontinuityTime."
        ::= { ospfGeneralGroup 9 }

  ospfRxNewLsas OBJECT-TYPE
       SYNTAX       Counter32
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
```

```
          "The number of link state advertisements received
          that are determined to be new instantiations.
          This number does not include newer instantiations
          of self-originated link state advertisements.

          Discontinuities in the value of this counter can
          occur at re-initialization of the management system,
          and at other times as indicated by the value of
          ospfDiscontinuityTime."
       ::= { ospfGeneralGroup 10 }

  ospfExtLsdbLimit OBJECT-TYPE
       SYNTAX       Integer32 (-1..'7FFFFFFF'h)
       MAX-ACCESS   read-write
       STATUS       current
       DESCRIPTION
          "The maximum number of non-default
          AS-external LSAs entries that can be stored in the
          link state database.  If the value is -1, then
          there is no limit.

          When the number of non-default AS-external LSAs
          in a router's link state database reaches
          ospfExtLsdbLimit, the router enters
          overflow state.  The router never holds more than
          ospfExtLsdbLimit non-default AS-external LSAs
          in its database.  OspfExtLsdbLimit MUST be set
          identically in all routers attached to the OSPF
          backbone and/or any regular OSPF area (i.e.,
          OSPF stub areas and NSSAs are excluded).

          This object is persistent and when written
          the entity SHOULD save the change to non-volatile
          storage."
        DEFVAL { -1 }
        ::= { ospfGeneralGroup 11 }

  ospfMulticastExtensions OBJECT-TYPE
       SYNTAX       Integer32
       MAX-ACCESS   read-write
       STATUS       current
       DESCRIPTION
          "A bit mask indicating whether the router is
          forwarding IP multicast (Class D) datagrams
          based on the algorithms defined in the
          multicast extensions to OSPF.

          Bit 0, if set, indicates that the router can
```

```
          forward IP multicast datagrams in the router's
          directly attached areas (called intra-area
          multicast routing).

          Bit 1, if set, indicates that the router can
          forward IP multicast datagrams between OSPF
          areas (called inter-area multicast routing).

          Bit 2, if set, indicates that the router can
          forward IP multicast datagrams between
          Autonomous Systems (called inter-AS multicast
          routing).

          Only certain combinations of bit settings are
          allowed, namely: 0 (no multicast forwarding is
          enabled), 1 (intra-area multicasting only), 3
          (intra-area and inter-area multicasting), 5
          (intra-area and inter-AS multicasting), and 7
          (multicasting everywhere).  By default, no
          multicast forwarding is enabled.

          This object is persistent and when written
          the entity SHOULD save the change to non-volatile
          storage."
      DEFVAL { 0 }
      ::= { ospfGeneralGroup 12 }

  ospfExitOverflowInterval OBJECT-TYPE
      SYNTAX       PositiveInteger
      MAX-ACCESS   read-write
      STATUS       current
      DESCRIPTION
          "The number of seconds that, after entering
          OverflowState, a router will attempt to leave
          OverflowState.  This allows the router to again
          originate non-default AS-external LSAs.  When
          set to 0, the router will not leave
          overflow state until restarted.

          This object is persistent and when written
          the entity SHOULD save the change to non-volatile
          storage."
      DEFVAL { 0 }
      ::= { ospfGeneralGroup 13 }

  ospfDemandExtensions OBJECT-TYPE
      SYNTAX       TruthValue
      MAX-ACCESS   read-write
```

```
       STATUS       current
       DESCRIPTION
          "The router's support for demand routing.
           This object is persistent and when written
           the entity SHOULD save the change to non-volatile
           storage."
       REFERENCE
          "Extending OSPF to Support Demand Circuits"
       ::= { ospfGeneralGroup 14 }

  ospfRFC1583Compatibility  OBJECT-TYPE
       SYNTAX       TruthValue
       MAX-ACCESS   read-write
       STATUS       current
       DESCRIPTION
          "Indicates metrics used to choose among multiple
          AS-external LSAs.  When RFC1583Compatibility is set to
          enabled, only cost will be used when choosing among
          multiple AS-external LSAs advertising the same
          destination.  When RFC1583Compatibility is set to
          disabled, preference will be driven first by type of
          path using cost only to break ties.

          This object is persistent and when written
          the entity SHOULD save the change to non-volatile
          storage."
        REFERENCE
           "OSPF Version 2, Section 16.4.1 External path
            preferences"
        ::= { ospfGeneralGroup 15 }

 ospfOpaqueLsaSupport  OBJECT-TYPE
       SYNTAX       TruthValue
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "The router's support for Opaque LSA types."
       REFERENCE
          "The OSPF Opaque LSA Option"
       ::= { ospfGeneralGroup 16 }

  ospfReferenceBandwidth OBJECT-TYPE
       SYNTAX       Unsigned32
       UNITS        "kilobits per second"
       MAX-ACCESS   read-write
       STATUS       current
       DESCRIPTION
          "Reference bandwidth in kilobits/second for
```

```
          calculating default interface metrics.  The
          default value is 100,000 KBPS (100 MBPS).

          This object is persistent and when written
          the entity SHOULD save the change to non-volatile
          storage."
      ::= { ospfGeneralGroup 17 }

  ospfRestartSupport OBJECT-TYPE
       SYNTAX       INTEGER { none (1),
                              plannedOnly (2),
                              plannedAndUnplanned (3)
                            }
       MAX-ACCESS   read-write
       STATUS       current
       DESCRIPTION
          "The router's support for OSPF graceful restart.
          Options include: no restart support, only planned
          restarts, or both planned and unplanned restarts.

          This object is persistent and when written
          the entity SHOULD save the change to non-volatile
          storage."
       ::= { ospfGeneralGroup 18 }

  ospfRestartInterval OBJECT-TYPE
       SYNTAX       Integer32 (1..1800)
       UNITS        "seconds"
       MAX-ACCESS   read-write
       STATUS       current
       DESCRIPTION
          "Configured OSPF graceful restart timeout interval.

           This object is persistent and when written
           the entity SHOULD save the change to non-volatile
           storage."
       ::= { ospfGeneralGroup 19 }

  ospfRestartStrictLsaChecking OBJECT-TYPE
       SYNTAX       TruthValue
       MAX-ACCESS   read-write
       STATUS       current
       DESCRIPTION
          "Indicates if strict LSA checking is enabled for
           graceful restart.

           This object is persistent and when written
           the entity SHOULD save the change to non-volatile
```

```
          storage."
      ::= { ospfGeneralGroup 20 }


  ospfRestartStatus OBJECT-TYPE
       SYNTAX       INTEGER { notRestarting (1),
                              plannedRestart (2),
                              unplannedRestart (3)
                            }
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "Current status of OSPF graceful restart."
       ::= { ospfGeneralGroup 21 }

  ospfRestartAge OBJECT-TYPE
       SYNTAX       Unsigned32
       UNITS        "seconds"
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "Remaining time in current OSPF graceful restart
          interval."
       ::= { ospfGeneralGroup 22 }

  ospfRestartExitReason OBJECT-TYPE
       SYNTAX       INTEGER { none (1),           -- none attempted
                              inProgress (2),     -- restart in
                                                  -- progress
                              completed (3),      -- successfully
                                                  -- completed
                              timedOut (4),       -- timed out
                              topologyChanged (5) -- aborted due to
                                                  -- topology change.
                            }
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "Describes the outcome of the last attempt at a
          graceful restart.  If the value is 'none', no restart
          has yet been attempted.  If the value is 'inProgress',
          a restart attempt is currently underway."
       ::= { ospfGeneralGroup 23 }

  ospfAsLsaCount OBJECT-TYPE
       SYNTAX       Gauge32
       MAX-ACCESS   read-only
       STATUS       current
```

```
        DESCRIPTION
            "The number of AS-scope link state
            advertisements in the AS-scope link state database."
        ::= { ospfGeneralGroup 24 }

    ospfAsLsaCksumSum OBJECT-TYPE
        SYNTAX       Unsigned32
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
            "The 32-bit unsigned sum of the LS checksums of
            the AS link state advertisements contained in the AS-scope
            link state database.  This sum can be used to determine
            if there has been a change in a router's AS-scope link
            state database, and to compare the AS-scope link state
            database of two routers."
        ::= { ospfGeneralGroup 25 }

     ospfStubRouterSupport OBJECT-TYPE
        SYNTAX       TruthValue
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
            "The router's support for stub router functionality."
        REFERENCE
            "OSPF Stub Router Advertisement"
        ::= { ospfGeneralGroup 26 }

     ospfStubRouterAdvertisement OBJECT-TYPE
        SYNTAX       INTEGER {
                           doNotAdvertise (1),
                           advertise(2)
                           }
        MAX-ACCESS   read-write
        STATUS       current
        DESCRIPTION
            "This object controls the advertisement of
            stub router LSAs by the router.  The value
            doNotAdvertise will result in the advertisement
            of a standard router LSA and is the default value.

            This object is persistent and when written
            the entity SHOULD save the change to non-volatile
            storage."
        ::= { ospfGeneralGroup 27 }

    ospfDiscontinuityTime OBJECT-TYPE
        SYNTAX     TimeStamp
```

```
      MAX-ACCESS read-only
      STATUS     current
      DESCRIPTION
         "The value of sysUpTime on the most recent occasion
          at which any one of this MIB's counters suffered
          a discontinuity.

          If no such discontinuities have occurred since the last
          re-initialization of the local management subsystem,
          then this object contains a zero value."
      ::= { ospfGeneralGroup 28 }


--  OSPF Area Table
--     The OSPF Area Table contains information
--     regarding the various areas.

  ospfAreaTable OBJECT-TYPE
       SYNTAX       SEQUENCE OF OspfAreaEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "Information describing the configured parameters and
          cumulative statistics of the router's attached areas.
          The interfaces and virtual links are configured
          as part of these areas.  Area 0.0.0.0, by definition,
          is the backbone area."
       REFERENCE
          "OSPF Version 2, Section 6 The Area Data Structure"
       ::= { ospf 2 }

  ospfAreaEntry OBJECT-TYPE
       SYNTAX       OspfAreaEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "Information describing the configured parameters and
          cumulative statistics of one of the router's attached areas.
          The interfaces and virtual links are configured as part of
          these areas.  Area 0.0.0.0, by definition, is the backbone
          area.

          Information in this table is persistent and when this object
          is written the entity SHOULD save the change to non-volatile
          storage."
       INDEX { ospfAreaId }
       ::= { ospfAreaTable 1 }
```

```
  OspfAreaEntry ::=
        SEQUENCE {
           ospfAreaId
              AreaID,
           ospfAuthType
              OspfAuthenticationType,
           ospfImportAsExtern
              INTEGER,
           ospfSpfRuns
              Counter32,
           ospfAreaBdrRtrCount
              Gauge32,
           ospfAsBdrRtrCount
              Gauge32,
           ospfAreaLsaCount
              Gauge32,
           ospfAreaLsaCksumSum
              Integer32,
           ospfAreaSummary
              INTEGER,
           ospfAreaStatus
              RowStatus,
           ospfAreaNssaTranslatorRole
              INTEGER,
           ospfAreaNssaTranslatorState
              INTEGER,
           ospfAreaNssaTranslatorStabilityInterval
              PositiveInteger,
           ospfAreaNssaTranslatorEvents
              Counter32
           }

  ospfAreaId OBJECT-TYPE
       SYNTAX       AreaID
       MAX-ACCESS   read-only -- read-only since originally
                              -- an SMIv1 index
       STATUS       current
       DESCRIPTION
          "A 32-bit integer uniquely identifying an area.
          Area ID 0.0.0.0 is used for the OSPF backbone."
       REFERENCE
          "OSPF Version 2, Appendix C.2 Area parameters"
       ::= { ospfAreaEntry 1 }

  ospfAuthType OBJECT-TYPE
       SYNTAX       OspfAuthenticationType
       MAX-ACCESS   read-create
       STATUS       obsolete
```

```
      DESCRIPTION
         "The authentication type specified for an area."
      REFERENCE
         "OSPF Version 2, Appendix D Authentication"
      DEFVAL { none } -- no authentication, by default
      ::= { ospfAreaEntry 2 }

  ospfImportAsExtern OBJECT-TYPE
      SYNTAX       INTEGER {
                     importExternal (1),
                     importNoExternal (2),
                     importNssa (3)
                     }
      MAX-ACCESS   read-create
      STATUS       current
      DESCRIPTION
         "Indicates if an area is a stub area, NSSA, or standard
         area.  Type-5 AS-external LSAs and type-11 Opaque LSAs are
         not imported into stub areas or NSSAs.  NSSAs import
         AS-external data as type-7 LSAs"
      REFERENCE
         "OSPF Version 2, Appendix C.2 Area parameters"
      DEFVAL { importExternal }
      ::= { ospfAreaEntry 3 }

  ospfSpfRuns OBJECT-TYPE
      SYNTAX       Counter32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The number of times that the intra-area route
         table has been calculated using this area's
         link state database.  This is typically done
         using Dijkstra's algorithm.

         Discontinuities in the value of this counter can occur
         at re-initialization of the management system, and at other
         times as indicated by the value of ospfDiscontinuityTime."
      ::= { ospfAreaEntry 4 }

  ospfAreaBdrRtrCount OBJECT-TYPE
      SYNTAX       Gauge32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The total number of Area Border Routers reachable
         within this area.  This is initially zero and is
         calculated in each Shortest Path First (SPF) pass."
```

```
      ::= { ospfAreaEntry 5 }

  ospfAsBdrRtrCount OBJECT-TYPE
      SYNTAX       Gauge32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The total number of Autonomous System Border
         Routers reachable within this area.  This is
         initially zero and is calculated in each SPF
         pass."
      ::= { ospfAreaEntry 6 }

  ospfAreaLsaCount OBJECT-TYPE
      SYNTAX       Gauge32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The total number of link state advertisements
         in this area's link state database, excluding
         AS-external LSAs."
      ::= { ospfAreaEntry 7 }

  ospfAreaLsaCksumSum OBJECT-TYPE
      SYNTAX       Integer32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The 32-bit sum of the link state
         advertisements' LS checksums contained in this
         area's link state database.  This sum excludes
         external (LS type-5) link state advertisements.
         The sum can be used to determine if there has
         been a change in a router's link state
         database, and to compare the link state database of
         two routers.  The value should be treated as unsigned
         when comparing two sums of checksums."
      DEFVAL { 0 }
      ::= { ospfAreaEntry 8 }

  ospfAreaSummary OBJECT-TYPE
      SYNTAX       INTEGER {
                      noAreaSummary (1),
                      sendAreaSummary (2)
                      }
      MAX-ACCESS   read-create
      STATUS       current
      DESCRIPTION
```

```
          "The variable ospfAreaSummary controls the
          import of summary LSAs into stub and NSSA areas.
          It has no effect on other areas.

          If it is noAreaSummary, the router will not
          originate summary LSAs into the stub or NSSA area.
          It will rely entirely on its default route.

          If it is sendAreaSummary, the router will both
          summarize and propagate summary LSAs."
       DEFVAL { noAreaSummary }
       ::= { ospfAreaEntry 9 }

  ospfAreaStatus OBJECT-TYPE
       SYNTAX       RowStatus
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "This object permits management of the table by
          facilitating actions such as row creation,
          construction, and destruction.

          The value of this object has no effect on
          whether other objects in this conceptual row can be
          modified."
       ::= { ospfAreaEntry 10 }

  ospfAreaNssaTranslatorRole OBJECT-TYPE
       SYNTAX       INTEGER { always (1), candidate (2) }
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "Indicates an NSSA border router's ability to
          perform NSSA translation of type-7 LSAs into
          type-5 LSAs."
       DEFVAL { candidate }
       ::= { ospfAreaEntry 11 }

  ospfAreaNssaTranslatorState OBJECT-TYPE
       SYNTAX       INTEGER { enabled (1),
                              elected (2),
                              disabled (3)
                              }
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "Indicates if and how an NSSA border router is
          performing NSSA translation of type-7 LSAs into type-5
```

```
          LSAs.  When this object is set to enabled, the NSSA Border
          router's OspfAreaNssaExtTranslatorRole has been set to
          always.  When this object is set to elected, a candidate
          NSSA Border router is Translating type-7 LSAs into type-5.
          When this object is set to disabled, a candidate NSSA
          border router is NOT translating type-7 LSAs into type-5."
      ::= { ospfAreaEntry 12 }

  ospfAreaNssaTranslatorStabilityInterval OBJECT-TYPE
      SYNTAX       PositiveInteger
      UNITS        "seconds"
      MAX-ACCESS   read-create
      STATUS       current
      DESCRIPTION
         "The number of seconds after an elected translator
         determines its services are no longer required, that
         it should continue to perform its translation duties."
      DEFVAL { 40 }
      ::= { ospfAreaEntry 13 }

  ospfAreaNssaTranslatorEvents OBJECT-TYPE
      SYNTAX       Counter32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "Indicates the number of translator state changes
         that have occurred since the last boot-up.

         Discontinuities in the value of this counter can occur
         at re-initialization of the management system, and at other
         times as indicated by the value of ospfDiscontinuityTime."
      ::= { ospfAreaEntry 14 }

--  OSPF Area Default Metric Table

  ospfStubAreaTable OBJECT-TYPE
      SYNTAX       SEQUENCE OF OspfStubAreaEntry
      MAX-ACCESS   not-accessible
      STATUS       current
      DESCRIPTION
         "The set of metrics that will be advertised
         by a default Area Border Router into a stub area."
      REFERENCE
         "OSPF Version 2, Appendix C.2, Area Parameters"
      ::= { ospf 3 }

  ospfStubAreaEntry OBJECT-TYPE
      SYNTAX       OspfStubAreaEntry
```

```
      MAX-ACCESS   not-accessible
      STATUS      current
      DESCRIPTION
         "The metric for a given Type of Service that
         will be advertised by a default Area Border
         Router into a stub area.

         Information in this table is persistent and when this object
         is written the entity SHOULD save the change to non-volatile
         storage."
      REFERENCE
         "OSPF Version 2, Appendix C.2, Area Parameters"
      INDEX { ospfStubAreaId, ospfStubTOS }
      ::= { ospfStubAreaTable 1 }

  OspfStubAreaEntry ::=
      SEQUENCE {
         ospfStubAreaId
            AreaID,
         ospfStubTOS
            TOSType,
         ospfStubMetric
            BigMetric,
         ospfStubStatus
            RowStatus,
         ospfStubMetricType
            INTEGER
         }

  ospfStubAreaId OBJECT-TYPE
      SYNTAX       AreaID
      MAX-ACCESS   read-only -- read-only since originally an
                             -- SMIv1 index
      STATUS       current
      DESCRIPTION
         "The 32-bit identifier for the stub area.  On
         creation, this can be derived from the
         instance."
      ::= { ospfStubAreaEntry 1 }

  ospfStubTOS OBJECT-TYPE
      SYNTAX       TOSType
      MAX-ACCESS   read-only -- read-only since originally an
                             -- SMIv1 index
      STATUS       current
      DESCRIPTION
         "The Type of Service associated with the
         metric.  On creation, this can be derived from
```

```
          the instance."
       ::= { ospfStubAreaEntry 2 }

  ospfStubMetric OBJECT-TYPE
       SYNTAX       BigMetric
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "The metric value applied at the indicated Type
          of Service.  By default, this equals the least
          metric at the Type of Service among the
          interfaces to other areas."
       ::= { ospfStubAreaEntry 3 }

  ospfStubStatus OBJECT-TYPE
       SYNTAX       RowStatus
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "This object permits management of the table by
          facilitating actions such as row creation,
          construction, and destruction.

          The value of this object has no effect on
          whether other objects in this conceptual row can be
          modified."
       ::= { ospfStubAreaEntry 4 }

  ospfStubMetricType OBJECT-TYPE
       SYNTAX       INTEGER {
                       ospfMetric (1),  -- OSPF Metric
                       comparableCost (2), -- external type 1
                       nonComparable  (3) -- external type 2
                       }
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "This variable displays the type of metric
          advertised as a default route."
       DEFVAL { ospfMetric }
       ::= { ospfStubAreaEntry 5 }

--  OSPF Link State Database

  ospfLsdbTable OBJECT-TYPE
       SYNTAX       SEQUENCE OF OspfLsdbEntry
       MAX-ACCESS   not-accessible
       STATUS       current
```

```
      DESCRIPTION
         "The OSPF Process's link state database (LSDB).
          The LSDB contains the link state advertisements
          from throughout the areas that the device is attached to."
      REFERENCE
         "OSPF Version 2, Section 12 Link State Advertisements"
      ::= { ospf 4 }

  ospfLsdbEntry OBJECT-TYPE
      SYNTAX   OspfLsdbEntry
      MAX-ACCESS   not-accessible
      STATUS   current
      DESCRIPTION
         "A single link state advertisement."
      INDEX { ospfLsdbAreaId, ospfLsdbType,
              ospfLsdbLsid, ospfLsdbRouterId }
      ::= { ospfLsdbTable 1 }

  OspfLsdbEntry ::=
      SEQUENCE {
         ospfLsdbAreaId
            AreaID,
         ospfLsdbType
            INTEGER,
         ospfLsdbLsid
            IpAddress,
         ospfLsdbRouterId
            RouterID,
         ospfLsdbSequence
            Integer32,
         ospfLsdbAge
            Integer32,
         ospfLsdbChecksum
            Integer32,
         ospfLsdbAdvertisement
            OCTET STRING
         }

  ospfLsdbAreaId OBJECT-TYPE
      SYNTAX       AreaID
      MAX-ACCESS   read-only -- read-only since originally an
                             -- SMIv1 index
      STATUS       current
      DESCRIPTION
         "The 32-bit identifier of the area from which
         the LSA was received."
      REFERENCE
         "OSPF Version 2, Appendix C.2 Area parameters"
```

```
      ::= { ospfLsdbEntry 1 }

  ospfLsdbType OBJECT-TYPE
      SYNTAX       INTEGER {
                      routerLink (1),
                      networkLink (2),
                      summaryLink (3),
                      asSummaryLink (4),
                      asExternalLink (5), -- but see ospfAsLsdbTable
                      multicastLink (6),
                      nssaExternalLink (7),
                      areaOpaqueLink (10)
                      }
      MAX-ACCESS   read-only -- read-only since originally an
                             -- SMIv1 index
      STATUS       current
      DESCRIPTION
         "The type of the link state advertisement.
         Each link state type has a separate advertisement
         format.

         Note: External link state advertisements are permitted
         for backward compatibility, but should be displayed
         in the ospfAsLsdbTable rather than here."
      REFERENCE
         "OSPF Version 2, Appendix A.4.1 The Link State
         Advertisement header"
      ::= { ospfLsdbEntry 2 }

  ospfLsdbLsid OBJECT-TYPE
      SYNTAX       IpAddress
      MAX-ACCESS   read-only -- read-only since originally an
                             -- SMIv1 index
      STATUS       current
      DESCRIPTION
         "The Link State ID is an LS Type Specific field
         containing either a Router ID or an IP address;
         it identifies the piece of the routing domain
         that is being described by the advertisement."
      REFERENCE
         "OSPF Version 2, Section 12.1.4 Link State ID"
      ::= { ospfLsdbEntry 3 }

  ospfLsdbRouterId OBJECT-TYPE
      SYNTAX       RouterID
      MAX-ACCESS   read-only -- read-only since originally an
                             -- SMIv1 index
      STATUS       current
```

```
        DESCRIPTION
           "The 32-bit number that uniquely identifies the
           originating router in the Autonomous System."
        REFERENCE
           "OSPF Version 2, Appendix C.1 Global parameters"
        ::= { ospfLsdbEntry 4 }

    ospfLsdbSequence OBJECT-TYPE
        SYNTAX       Integer32
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "The sequence number field is a signed 32-bit
           integer.  It starts with the value '80000001'h,
           or -'7FFFFFFF'h, and increments until '7FFFFFFF'h.
           Thus, a typical sequence number will be very negative.
           It is used to detect old and duplicate Link State
           Advertisements.  The space of sequence numbers is linearly
           ordered.  The larger the sequence number, the more recent
           the advertisement."
        REFERENCE
           "OSPF Version 2, Section 12.1.6 LS sequence
           number"
        ::= { ospfLsdbEntry 5 }

    ospfLsdbAge OBJECT-TYPE
        SYNTAX       Integer32 -- Should be 0..MaxAge, except when
                               -- doNotAge bit is set
        UNITS        "seconds"
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "This field is the age of the link state advertisement
           in seconds."
        REFERENCE
           "OSPF Version 2, Section 12.1.1 LS age"
        ::= { ospfLsdbEntry 6 }

    ospfLsdbChecksum OBJECT-TYPE
        SYNTAX       Integer32
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "This field is the checksum of the complete contents of
           the advertisement, excepting the age field.  The age field
           is excepted so that an advertisement's age can be
           incremented without updating the checksum.  The checksum
           used is the same that is used for ISO connectionless
```

```
          datagrams; it is commonly referred to as the
          Fletcher checksum."
        REFERENCE
           "OSPF Version 2, Section 12.1.7 LS checksum"
        ::= { ospfLsdbEntry 7 }

  ospfLsdbAdvertisement OBJECT-TYPE
       SYNTAX       OCTET STRING (SIZE (1..65535))
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "The entire link state advertisement, including
          its header.

          Note that for variable length LSAs, SNMP agents
          may not be able to return the largest string size."
       REFERENCE
          "OSPF Version 2, Section 12 Link State Advertisements"
       ::= { ospfLsdbEntry 8 }

--  Address Range Table

  ospfAreaRangeTable OBJECT-TYPE
       SYNTAX       SEQUENCE OF OspfAreaRangeEntry
       MAX-ACCESS   not-accessible
       STATUS       obsolete
       DESCRIPTION
          "The Address Range Table acts as an adjunct to the Area
           Table.  It describes those Address Range Summaries that
           are configured to be propagated from an Area to reduce
           the amount of information about it that is known beyond
           its borders.  It contains a set of IP address ranges
           specified by an IP address/IP network mask pair.
           For example, class B address range of X.X.X.X
           with a network mask of 255.255.0.0 includes all IP
           addresses from X.X.0.0 to X.X.255.255.

           Note that this table is obsoleted and is replaced
           by the Area Aggregate Table."
       REFERENCE
          "OSPF Version 2, Appendix C.2  Area parameters"
       ::= { ospf 5 }

  ospfAreaRangeEntry OBJECT-TYPE
       SYNTAX       OspfAreaRangeEntry
       MAX-ACCESS   not-accessible
       STATUS       obsolete
       DESCRIPTION
```

```
          "A single area address range.

          Information in this table is persistent and when this object
          is written the entity SHOULD save the change to non-volatile
          storage."
       REFERENCE
          "OSPF Version 2, Appendix C.2  Area parameters"
       INDEX { ospfAreaRangeAreaId, ospfAreaRangeNet }
       ::= { ospfAreaRangeTable 1 }

  OspfAreaRangeEntry ::=
       SEQUENCE {
          ospfAreaRangeAreaId
             AreaID,
          ospfAreaRangeNet
             IpAddress,
          ospfAreaRangeMask
             IpAddress,
          ospfAreaRangeStatus
             RowStatus,
          ospfAreaRangeEffect
             INTEGER
          }

  ospfAreaRangeAreaId OBJECT-TYPE
       SYNTAX       AreaID
       MAX-ACCESS   read-only -- read-only since originally an
                              -- SMIv1 index
       STATUS       obsolete
       DESCRIPTION
          "The area that the address range is to be found
          within."
       REFERENCE
          "OSPF Version 2, Appendix C.2 Area parameters"
       ::= { ospfAreaRangeEntry 1 }

  ospfAreaRangeNet OBJECT-TYPE
       SYNTAX       IpAddress
       MAX-ACCESS   read-only -- read-only since originally an
                              -- SMIv1 index
       STATUS       obsolete
       DESCRIPTION
          "The IP address of the net or subnet indicated
          by the range."
       REFERENCE
          "OSPF Version 2, Appendix C.2 Area parameters"
       ::= { ospfAreaRangeEntry 2 }
```

```
  ospfAreaRangeMask OBJECT-TYPE
       SYNTAX       IpAddress
       MAX-ACCESS   read-create
       STATUS       obsolete
       DESCRIPTION
          "The subnet mask that pertains to the net or
          subnet."
       REFERENCE
          "OSPF Version 2, Appendix C.2 Area parameters"
       ::= { ospfAreaRangeEntry 3 }

  ospfAreaRangeStatus OBJECT-TYPE
       SYNTAX       RowStatus
       MAX-ACCESS   read-create
       STATUS       obsolete
       DESCRIPTION
          "This object permits management of the table by
          facilitating actions such as row creation,
          construction, and destruction.

          The value of this object has no effect on
          whether other objects in this conceptual row can be
          modified."
       ::= { ospfAreaRangeEntry 4 }

  ospfAreaRangeEffect OBJECT-TYPE
       SYNTAX       INTEGER {
                       advertiseMatching (1),
                       doNotAdvertiseMatching (2)
                       }
       MAX-ACCESS   read-create
       STATUS       obsolete
       DESCRIPTION
          "Subnets subsumed by ranges either trigger the
          advertisement of the indicated summary
         (advertiseMatching) or result in the subnet's not
          being advertised at all outside the area."
       DEFVAL { advertiseMatching }
       ::= { ospfAreaRangeEntry 5 }

--  OSPF Host Table

  ospfHostTable OBJECT-TYPE
       SYNTAX       SEQUENCE OF OspfHostEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "The Host/Metric Table indicates what hosts are directly
```

```
         attached to the router, what metrics and types
         of service should be advertised for them,
         and what areas they are found within."
      REFERENCE
         "OSPF Version 2, Appendix C.7 Host route
         parameters"
      ::= { ospf 6 }

  ospfHostEntry OBJECT-TYPE
      SYNTAX       OspfHostEntry
      MAX-ACCESS   not-accessible
      STATUS       current
      DESCRIPTION
         "A metric to be advertised, for a given type of
         service, when a given host is reachable.

         Information in this table is persistent and when this object
         is written the entity SHOULD save the change to non-volatile
         storage."
      INDEX { ospfHostIpAddress, ospfHostTOS }
      ::= { ospfHostTable 1 }

  OspfHostEntry ::=
      SEQUENCE {
         ospfHostIpAddress
            IpAddress,
         ospfHostTOS
            TOSType,
         ospfHostMetric
            Metric,
         ospfHostStatus
            RowStatus,
         ospfHostAreaID
            AreaID,
         ospfHostCfgAreaID
            AreaID
         }

  ospfHostIpAddress OBJECT-TYPE
      SYNTAX       IpAddress
      MAX-ACCESS   read-only -- read-only since originally an
                             -- SMIv1 index
      STATUS       current
      DESCRIPTION
         "The IP address of the host."
      REFERENCE
         "OSPF Version 2, Appendix C.7 Host route parameters"
      ::= { ospfHostEntry 1 }
```

```
  ospfHostTOS OBJECT-TYPE
       SYNTAX       TOSType
       MAX-ACCESS   read-only -- read-only since originally an
                              -- SMIv1 index
       STATUS       current
       DESCRIPTION
          "The Type of Service of the route being configured."
       REFERENCE
          "OSPF Version 2, Appendix C.7 Host route parameters"
       ::= { ospfHostEntry 2 }

  ospfHostMetric OBJECT-TYPE
       SYNTAX       Metric
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "The metric to be advertised."
       REFERENCE
          "OSPF Version 2, Appendix C.7 Host route parameters"
       ::= { ospfHostEntry 3 }

  ospfHostStatus OBJECT-TYPE
       SYNTAX       RowStatus
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "This object permits management of the table by
          facilitating actions such as row creation,
          construction, and destruction.

          The value of this object has no effect on
          whether other objects in this conceptual row can be
          modified."
       ::= { ospfHostEntry 4 }

  ospfHostAreaID OBJECT-TYPE
       SYNTAX       AreaID
       MAX-ACCESS   read-only
       STATUS       deprecated
       DESCRIPTION
          "The OSPF area to which the host belongs.
          Deprecated by ospfHostCfgAreaID."
       REFERENCE
          "OSPF Version 2, Appendix C.7 Host parameters"
       ::= { ospfHostEntry 5 }

  ospfHostCfgAreaID OBJECT-TYPE
       SYNTAX       AreaID
```

```
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "To configure the OSPF area to which the host belongs."
       REFERENCE
          "OSPF Version 2, Appendix C.7 Host parameters"
       ::= { ospfHostEntry 6 }

--  OSPF Interface Table

  ospfIfTable OBJECT-TYPE
       SYNTAX       SEQUENCE OF OspfIfEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "The OSPF Interface Table describes the interfaces
          from the viewpoint of OSPF.
          It augments the ipAddrTable with OSPF specific information."
       REFERENCE
          "OSPF Version 2, Appendix C.3  Router interface
          parameters"
       ::= { ospf 7 }

  ospfIfEntry OBJECT-TYPE
       SYNTAX       OspfIfEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "The OSPF interface entry describes one interface
          from the viewpoint of OSPF.

          Information in this table is persistent and when this object
          is written the entity SHOULD save the change to non-volatile
          storage."
       INDEX { ospfIfIpAddress, ospfAddressLessIf }
       ::= { ospfIfTable 1 }

  OspfIfEntry ::=
       SEQUENCE {
          ospfIfIpAddress
             IpAddress,
          ospfAddressLessIf
             InterfaceIndexOrZero,
          ospfIfAreaId
             AreaID,
          ospfIfType
             INTEGER,
          ospfIfAdminStat
```

```
            Status,
         ospfIfRtrPriority
            DesignatedRouterPriority,
         ospfIfTransitDelay
            UpToMaxAge,
         ospfIfRetransInterval
            UpToMaxAge,
         ospfIfHelloInterval
            HelloRange,
         ospfIfRtrDeadInterval
            PositiveInteger,
         ospfIfPollInterval
            PositiveInteger,
         ospfIfState
            INTEGER,
         ospfIfDesignatedRouter
            IpAddress,
         ospfIfBackupDesignatedRouter
            IpAddress,
         ospfIfEvents
            Counter32,
         ospfIfAuthKey
            OCTET STRING,
         ospfIfStatus
            RowStatus,
         ospfIfMulticastForwarding
            INTEGER,
         ospfIfDemand
            TruthValue,
         ospfIfAuthType
            OspfAuthenticationType,
         ospfIfLsaCount
            Gauge32,
         ospfIfLsaCksumSum
            Unsigned32,
         ospfIfDesignatedRouterId
            RouterID,
         ospfIfBackupDesignatedRouterId
            RouterID
         }

  ospfIfIpAddress OBJECT-TYPE
       SYNTAX       IpAddress
       MAX-ACCESS   read-only -- read-only since originally an
                              -- SMIv1 index
       STATUS       current
       DESCRIPTION
          "The IP address of this OSPF interface."
```

```
      ::= { ospfIfEntry 1 }

  ospfAddressLessIf OBJECT-TYPE
       SYNTAX       InterfaceIndexOrZero
       MAX-ACCESS   read-only -- read-only since originally an
                              -- SMIv1 index
       STATUS       current
       DESCRIPTION
          "For the purpose of easing the instancing of
          addressed and addressless interfaces; this
          variable takes the value 0 on interfaces with
          IP addresses and the corresponding value of
          ifIndex for interfaces having no IP address."
       ::= { ospfIfEntry 2 }

  ospfIfAreaId OBJECT-TYPE
       SYNTAX       AreaID
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "A 32-bit integer uniquely identifying the area
          to which the interface connects.  Area ID
          0.0.0.0 is used for the OSPF backbone."
       DEFVAL { '00000000'H }  -- 0.0.0.0
       ::= { ospfIfEntry 3 }

  ospfIfType OBJECT-TYPE
       SYNTAX       INTEGER {
                       broadcast (1),
                       nbma (2),
                       pointToPoint (3),
                       pointToMultipoint (5)
                       }
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "The OSPF interface type.
          By way of a default, this field may be intuited
          from the corresponding value of ifType.
          Broadcast LANs, such as Ethernet and IEEE 802.5,
          take the value 'broadcast', X.25 and similar
          technologies take the value 'nbma', and links
          that are definitively point to point take the
          value 'pointToPoint'."
        ::= { ospfIfEntry 4 }

  ospfIfAdminStat OBJECT-TYPE
       SYNTAX       Status
```

```
      MAX-ACCESS   read-create
      STATUS       current
      DESCRIPTION
         "The OSPF interface's administrative status.
         The value formed on the interface, and the interface
         will be advertised as an internal route to some area.
         The value 'disabled' denotes that the interface is
         external to OSPF."
      DEFVAL { enabled }
      ::= { ospfIfEntry 5 }

  ospfIfRtrPriority OBJECT-TYPE
      SYNTAX       DesignatedRouterPriority
      MAX-ACCESS   read-create
      STATUS       current
      DESCRIPTION
         "The priority of this interface.  Used in
         multi-access networks, this field is used in
         the designated router election algorithm.  The
         value 0 signifies that the router is not eligible
         to become the designated router on this particular
         network.  In the event of a tie in this value,
         routers will use their Router ID as a tie breaker."
       DEFVAL { 1 }
       ::= { ospfIfEntry 6 }

  ospfIfTransitDelay OBJECT-TYPE
       SYNTAX       UpToMaxAge
       UNITS        "seconds"
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "The estimated number of seconds it takes to
          transmit a link state update packet over this
          interface.  Note that the minimal value SHOULD be
          1 second."
       DEFVAL { 1 }
       ::= { ospfIfEntry 7 }

  ospfIfRetransInterval OBJECT-TYPE
      SYNTAX       UpToMaxAge
      UNITS        "seconds"
      MAX-ACCESS   read-create
      STATUS       current
      DESCRIPTION
         "The number of seconds between link state advertisement
         retransmissions, for adjacencies belonging to this
         interface.  This value is also used when retransmitting
```

```
          database description and Link State request packets.
          Note that minimal value SHOULD be 1 second."
       DEFVAL { 5 }
       ::= { ospfIfEntry 8 }

  ospfIfHelloInterval OBJECT-TYPE
       SYNTAX       HelloRange
       UNITS        "seconds"
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "The length of time, in seconds, between the Hello packets
          that the router sends on the interface.  This value must be
          the same for all routers attached to a common network."
       DEFVAL { 10 }
       ::= { ospfIfEntry 9 }

  ospfIfRtrDeadInterval OBJECT-TYPE
       SYNTAX       PositiveInteger
       UNITS        "seconds"
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "The number of seconds that a router's Hello packets have
          not been seen before its neighbors declare the router down.
          This should be some multiple of the Hello interval.  This
          value must be the same for all routers attached to a common
          network."
        DEFVAL { 40 }
        ::= { ospfIfEntry 10 }

  ospfIfPollInterval OBJECT-TYPE
       SYNTAX       PositiveInteger
       UNITS        "seconds"
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "The larger time interval, in seconds, between the Hello
          packets sent to an inactive non-broadcast multi-access
          neighbor."
       DEFVAL { 120 }
       ::= { ospfIfEntry 11 }

  ospfIfState OBJECT-TYPE
       SYNTAX       INTEGER {
                       down (1),
                       loopback (2),
                       waiting (3),
```

```
                        pointToPoint (4),
                        designatedRouter (5),
                        backupDesignatedRouter (6),
                        otherDesignatedRouter (7)
                        }
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "The OSPF Interface State."
        DEFVAL { down }
        ::= { ospfIfEntry 12 }

    ospfIfDesignatedRouter OBJECT-TYPE
        SYNTAX       IpAddress
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "The IP address of the designated router."
        DEFVAL { '00000000'H } -- 0.0.0.0
        ::= { ospfIfEntry 13 }

    ospfIfBackupDesignatedRouter OBJECT-TYPE
        SYNTAX       IpAddress
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "The IP address of the backup designated
           router."
        DEFVAL { '00000000'H }  -- 0.0.0.0
        ::= { ospfIfEntry 14 }

    ospfIfEvents OBJECT-TYPE
        SYNTAX       Counter32
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "The number of times this OSPF interface has
           changed its state or an error has occurred.

           Discontinuities in the value of this counter can occur
           at re-initialization of the management system, and at other
           times as indicated by the value of ospfDiscontinuityTime."
        ::= { ospfIfEntry 15 }

    ospfIfAuthKey OBJECT-TYPE
        SYNTAX       OCTET STRING (SIZE (0..256))
        MAX-ACCESS   read-create
        STATUS       current
```

```
      DESCRIPTION
         "The cleartext password used as an OSPF
         authentication key when simplePassword security
         is enabled.  This object does not access any OSPF
         cryptogaphic (e.g., MD5) authentication key under
         any circumstance.

         If the key length is shorter than 8 octets, the
         agent will left adjust and zero fill to 8 octets.

         Unauthenticated interfaces need no authentication
         key, and simple password authentication cannot use
         a key of more than 8 octets.

         Note that the use of simplePassword authentication
         is NOT recommended when there is concern regarding
         attack upon the OSPF system.  SimplePassword
         authentication is only sufficient to protect against
         accidental misconfigurations because it re-uses
         cleartext passwords [RFC1704].

         When read, ospfIfAuthKey always returns an octet
         string of length zero."
      REFERENCE
         "OSPF Version 2, Section 9 The Interface Data
         Structure"
      DEFVAL { '0000000000000000'H } -- 0.0.0.0.0.0.0.0
      ::= { ospfIfEntry 16 }

  ospfIfStatus OBJECT-TYPE
      SYNTAX       RowStatus
      MAX-ACCESS   read-create
      STATUS       current
      DESCRIPTION
         "This object permits management of the table by
         facilitating actions such as row creation,
         construction, and destruction.

         The value of this object has no effect on
         whether other objects in this conceptual row can be
         modified."
      ::= { ospfIfEntry 17 }

  ospfIfMulticastForwarding OBJECT-TYPE
      SYNTAX       INTEGER {
                      blocked (1), -- no multicast forwarding
                      multicast (2), -- using multicast address
                      unicast (3) -- to each OSPF neighbor
```

```
                    }
      MAX-ACCESS   read-create
      STATUS       current
      DESCRIPTION
         "The way multicasts should be forwarded on this
         interface: not forwarded, forwarded as data
         link multicasts, or forwarded as data link
         unicasts.  Data link multicasting is not
         meaningful on point-to-point and NBMA interfaces,
         and setting ospfMulticastForwarding to 0 effectively
         disables all multicast forwarding."
      DEFVAL { blocked }
      ::= { ospfIfEntry 18 }

  ospfIfDemand OBJECT-TYPE
      SYNTAX       TruthValue
      MAX-ACCESS   read-create
      STATUS       current
      DESCRIPTION
         "Indicates whether Demand OSPF procedures (hello
         suppression to FULL neighbors and setting the
         DoNotAge flag on propagated LSAs) should be
         performed on this interface."
      DEFVAL { false }
      ::= { ospfIfEntry 19 }

  ospfIfAuthType OBJECT-TYPE
      SYNTAX       OspfAuthenticationType
      MAX-ACCESS   read-create
      STATUS       current
      DESCRIPTION
         "The authentication type specified for an interface.

         Note that this object can be used to engage
         in significant attacks against an OSPF router."
      REFERENCE
         "OSPF Version 2, Appendix D Authentication"
      DEFVAL { none } -- no authentication, by default
      ::= { ospfIfEntry 20 }

  ospfIfLsaCount OBJECT-TYPE
      SYNTAX       Gauge32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The total number of link-local link state advertisements
         in this interface's link-local link state database."
      ::= { ospfIfEntry 21 }
```

```
  ospfIfLsaCksumSum OBJECT-TYPE
       SYNTAX       Unsigned32
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "The 32-bit unsigned sum of the Link State
          Advertisements' LS checksums contained in this
          interface's link-local link state database.
          The sum can be used to determine if there has
          been a change in the interface's link state
          database and to compare the interface link state
          database of routers attached to the same subnet."
       ::= { ospfIfEntry 22 }

  ospfIfDesignatedRouterId OBJECT-TYPE
       SYNTAX       RouterID
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "The Router ID of the designated router."
       ::= { ospfIfEntry 23 }

  ospfIfBackupDesignatedRouterId OBJECT-TYPE
       SYNTAX       RouterID
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "The Router ID of the backup designated router."
       ::= { ospfIfEntry 24 }

--  OSPF Interface Metric Table

  ospfIfMetricTable OBJECT-TYPE
       SYNTAX       SEQUENCE OF OspfIfMetricEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "The Metric Table describes the metrics to be advertised
          for a specified interface at the various types of service.
          As such, this table is an adjunct of the OSPF Interface
          Table.

          Types of service, as defined by RFC 791, have the ability
          to request low delay, high bandwidth, or reliable linkage.

          For the purposes of this specification, the measure of
          bandwidth:
```

```
          Metric = referenceBandwidth / ifSpeed

          is the default value.
          The default reference bandwidth is 10^8.
          For multiple link interfaces, note that ifSpeed is the sum
          of the individual link speeds.  This yields a number having
          the following typical values:

          Network Type/bit rate   Metric

          >= 100 MBPS               1
          Ethernet/802.3           10
          E1                       48
          T1 (ESF)                 65
          64 KBPS                1562
          56 KBPS                1785
          19.2 KBPS              5208
          9.6 KBPS              10416

          Routes that are not specified use the default
          (TOS 0) metric.

          Note that the default reference bandwidth can be configured
          using the general group object ospfReferenceBandwidth."
       REFERENCE
          "OSPF Version 2, Appendix C.3 Router interface
          parameters"
       ::= { ospf 8 }

  ospfIfMetricEntry OBJECT-TYPE
       SYNTAX       OspfIfMetricEntry
       MAX-ACCESS   not-accessible
       STATUS      current
       DESCRIPTION
          "A particular TOS metric for a non-virtual interface
          identified by the interface index.

          Information in this table is persistent and when this object
          is written the entity SHOULD save the change to non-volatile
          storage."
       REFERENCE
          "OSPF Version 2, Appendix C.3 Router interface
          parameters"
       INDEX { ospfIfMetricIpAddress,
          ospfIfMetricAddressLessIf,
          ospfIfMetricTOS }
       ::= { ospfIfMetricTable 1 }
```

```
  OspfIfMetricEntry ::=
       SEQUENCE {
          ospfIfMetricIpAddress
             IpAddress,
          ospfIfMetricAddressLessIf
             InterfaceIndexOrZero,
          ospfIfMetricTOS
             TOSType,
          ospfIfMetricValue
             Metric,
          ospfIfMetricStatus
             RowStatus
          }

  ospfIfMetricIpAddress OBJECT-TYPE
       SYNTAX       IpAddress
       MAX-ACCESS   read-only -- read-only since originally an
                              -- SMIv1 index
       STATUS       current
       DESCRIPTION
          "The IP address of this OSPF interface.  On row
          creation, this can be derived from the instance."
       ::= { ospfIfMetricEntry 1 }

  ospfIfMetricAddressLessIf OBJECT-TYPE
       SYNTAX       InterfaceIndexOrZero
       MAX-ACCESS   read-only -- read-only since originally an
                              -- SMIv1 index
       STATUS       current
       DESCRIPTION
          "For the purpose of easing the instancing of
          addressed and addressless interfaces; this
          variable takes the value 0 on interfaces with
          IP addresses and the value of ifIndex for
          interfaces having no IP address.  On row
          creation, this can be derived from the instance."
        ::= { ospfIfMetricEntry 2 }

  ospfIfMetricTOS OBJECT-TYPE
       SYNTAX       TOSType
       MAX-ACCESS   read-only -- read-only since originally an
                              -- SMIv1 index
       STATUS       current
       DESCRIPTION
          "The Type of Service metric being referenced.
          On row creation, this can be derived from the
          instance."
       ::= { ospfIfMetricEntry 3 }
```

```
  ospfIfMetricValue OBJECT-TYPE
       SYNTAX       Metric
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "The metric of using this Type of Service on
          this interface.  The default value of the TOS 0
          metric is 10^8 / ifSpeed."
       ::= { ospfIfMetricEntry 4 }

  ospfIfMetricStatus OBJECT-TYPE
       SYNTAX       RowStatus
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "This object permits management of the table by
          facilitating actions such as row creation,
          construction, and destruction.

          The value of this object has no effect on
          whether other objects in this conceptual row can be
          modified."
       ::= { ospfIfMetricEntry 5 }

--  OSPF Virtual Interface Table

  ospfVirtIfTable OBJECT-TYPE
       SYNTAX       SEQUENCE OF OspfVirtIfEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "Information about this router's virtual interfaces
          that the OSPF Process is configured to carry on."
       REFERENCE
          "OSPF Version 2, Appendix C.4  Virtual link
          parameters"
       ::= { ospf 9 }

  ospfVirtIfEntry OBJECT-TYPE
       SYNTAX       OspfVirtIfEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "Information about a single virtual interface.

          Information in this table is persistent and when this object
          is written the entity SHOULD save the change to non-volatile
          storage."
```

```
      INDEX { ospfVirtIfAreaId, ospfVirtIfNeighbor }
      ::= { ospfVirtIfTable 1 }

  OspfVirtIfEntry ::=
      SEQUENCE {
         ospfVirtIfAreaId
            AreaID,
         ospfVirtIfNeighbor
            RouterID,
         ospfVirtIfTransitDelay
            UpToMaxAge,
         ospfVirtIfRetransInterval
            UpToMaxAge,
         ospfVirtIfHelloInterval
            HelloRange,
         ospfVirtIfRtrDeadInterval
            PositiveInteger,
         ospfVirtIfState
            INTEGER,
         ospfVirtIfEvents
            Counter32,
         ospfVirtIfAuthKey
            OCTET STRING,
         ospfVirtIfStatus
            RowStatus,
         ospfVirtIfAuthType
            OspfAuthenticationType,
         ospfVirtIfLsaCount
            Gauge32,
         ospfVirtIfLsaCksumSum
            Unsigned32
         }

  ospfVirtIfAreaId OBJECT-TYPE
      SYNTAX       AreaID
      MAX-ACCESS   read-only -- read-only since originally an
                             -- SMIv1 index
      STATUS       current
      DESCRIPTION
         "The transit area that the virtual link
         traverses.  By definition, this is not 0.0.0.0"
      ::= { ospfVirtIfEntry 1 }

  ospfVirtIfNeighbor OBJECT-TYPE
      SYNTAX       RouterID
      MAX-ACCESS   read-only -- read-only since originally an
                             -- SMIv1 index
      STATUS       current
```

```
      DESCRIPTION
         "The Router ID of the virtual neighbor."
      ::= { ospfVirtIfEntry 2 }

  ospfVirtIfTransitDelay OBJECT-TYPE
      SYNTAX       UpToMaxAge
      UNITS        "seconds"
      MAX-ACCESS   read-create
      STATUS       current
      DESCRIPTION
         "The estimated number of seconds it takes to
         transmit a Link State update packet over this
         interface.  Note that the minimal value SHOULD be
         1 second."
      DEFVAL { 1 }
      ::= { ospfVirtIfEntry 3 }

  ospfVirtIfRetransInterval OBJECT-TYPE
      SYNTAX       UpToMaxAge
      UNITS        "seconds"
      MAX-ACCESS   read-create
      STATUS       current
      DESCRIPTION
         "The number of seconds between link state
         avertisement retransmissions, for adjacencies
         belonging to this interface.  This value is
         also used when retransmitting database
         description and Link State request packets.  This
         value should be well over the expected
         round-trip time.  Note that the minimal value SHOULD be
         1 second."
      DEFVAL { 5 }
      ::= { ospfVirtIfEntry 4 }

  ospfVirtIfHelloInterval OBJECT-TYPE
      SYNTAX       HelloRange
      UNITS        "seconds"
      MAX-ACCESS   read-create
      STATUS       current
      DESCRIPTION
         "The length of time, in seconds, between the
         Hello packets that the router sends on the
         interface.  This value must be the same for the
         virtual neighbor."
      DEFVAL { 10 }
      ::= { ospfVirtIfEntry 5 }

  ospfVirtIfRtrDeadInterval OBJECT-TYPE
```

```
      SYNTAX       PositiveInteger
      UNITS        "seconds"
      MAX-ACCESS   read-create
      STATUS       current
      DESCRIPTION
         "The number of seconds that a router's Hello
         packets have not been seen before its
         neighbors declare the router down.  This should be
         some multiple of the Hello interval.  This
         value must be the same for the virtual neighbor."
      DEFVAL { 60 }
      ::= { ospfVirtIfEntry 6 }

  ospfVirtIfState OBJECT-TYPE
      SYNTAX       INTEGER {
                      down (1), -- these use the same encoding
                      pointToPoint (4) -- as the ospfIfTable
                      }
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "OSPF virtual interface states."
      DEFVAL { down }
      ::= { ospfVirtIfEntry 7 }

  ospfVirtIfEvents OBJECT-TYPE
      SYNTAX       Counter32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The number of state changes or error events on
         this virtual link.

         Discontinuities in the value of this counter can occur
         at re-initialization of the management system, and at other
         times as indicated by the value of ospfDiscontinuityTime."
      ::= { ospfVirtIfEntry 8 }

  ospfVirtIfAuthKey OBJECT-TYPE
      SYNTAX       OCTET STRING (SIZE(0..256))
      MAX-ACCESS   read-create
      STATUS       current
      DESCRIPTION
         "The cleartext password used as an OSPF
         authentication key when simplePassword security
         is enabled.  This object does not access any OSPF
         cryptogaphic (e.g., MD5) authentication key under
         any circumstance.
```

```
          If the key length is shorter than 8 octets, the
          agent will left adjust and zero fill to 8 octets.

          Unauthenticated interfaces need no authentication
          key, and simple password authentication cannot use
          a key of more than 8 octets.

          Note that the use of simplePassword authentication
          is NOT recommended when there is concern regarding
          attack upon the OSPF system.  SimplePassword
          authentication is only sufficient to protect against
          accidental misconfigurations because it re-uses
          cleartext passwords.  [RFC1704]

          When read, ospfIfAuthKey always returns an octet
          string of length zero."
      REFERENCE
          "OSPF Version 2, Section 9 The Interface Data
          Structure"
      DEFVAL { '0000000000000000'H } -- 0.0.0.0.0.0.0.0
      ::= { ospfVirtIfEntry 9 }

  ospfVirtIfStatus OBJECT-TYPE
      SYNTAX       RowStatus
      MAX-ACCESS   read-create
      STATUS       current
      DESCRIPTION
          "This object permits management of the table by
          facilitating actions such as row creation,
          construction, and destruction.

          The value of this object has no effect on
          whether other objects in this conceptual row can be
          modified."
       ::= { ospfVirtIfEntry 10 }

  ospfVirtIfAuthType OBJECT-TYPE
      SYNTAX       OspfAuthenticationType
      MAX-ACCESS   read-create
      STATUS       current
      DESCRIPTION
          "The authentication type specified for a virtual interface.

          Note that this object can be used to engage
          in significant attacks against an OSPF router."
      REFERENCE
          "OSPF Version 2, Appendix E Authentication"
      DEFVAL { none } -- no authentication, by default
```

```
        ::= { ospfVirtIfEntry 11 }

  ospfVirtIfLsaCount OBJECT-TYPE
        SYNTAX       Gauge32
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "The total number of link-local link state advertisements
           in this virtual interface's link-local link state database."
        ::= { ospfVirtIfEntry 12 }

  ospfVirtIfLsaCksumSum OBJECT-TYPE
        SYNTAX       Unsigned32
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "The 32-bit unsigned sum of the link state
           advertisements' LS checksums contained in this
           virtual interface's link-local link state database.
           The sum can be used to determine if there has
           been a change in the virtual interface's link state
           database, and to compare the virtual interface
           link state database of the virtual neighbors."
        ::= { ospfVirtIfEntry 13 }

--  OSPF Neighbor Table

  ospfNbrTable OBJECT-TYPE
        SYNTAX       SEQUENCE OF OspfNbrEntry
        MAX-ACCESS   not-accessible
        STATUS       current
        DESCRIPTION
           "A table describing all non-virtual neighbors
           in the locality of the OSPF router."
        REFERENCE
           "OSPF Version 2, Section 10 The Neighbor Data
           Structure"
        ::= { ospf 10 }

  ospfNbrEntry OBJECT-TYPE
        SYNTAX       OspfNbrEntry
        MAX-ACCESS   not-accessible
        STATUS       current
        DESCRIPTION
           "The information regarding a single neighbor.

           Information in this table is persistent and when this object
           is written the entity SHOULD save the change to non-volatile
```

```
            storage."
         REFERENCE
            "OSPF Version 2, Section 10 The Neighbor Data
            Structure"
         INDEX { ospfNbrIpAddr, ospfNbrAddressLessIndex }
         ::= { ospfNbrTable 1 }

   OspfNbrEntry ::=
         SEQUENCE {
            ospfNbrIpAddr
               IpAddress,
            ospfNbrAddressLessIndex
               InterfaceIndexOrZero,
            ospfNbrRtrId
               RouterID,
            ospfNbrOptions
               Integer32,
            ospfNbrPriority
               DesignatedRouterPriority,
            ospfNbrState
               INTEGER,
            ospfNbrEvents
               Counter32,
            ospfNbrLsRetransQLen
               Gauge32,
            ospfNbmaNbrStatus
               RowStatus,
            ospfNbmaNbrPermanence
               INTEGER,
            ospfNbrHelloSuppressed
               TruthValue,
            ospfNbrRestartHelperStatus
               INTEGER,
            ospfNbrRestartHelperAge
               Unsigned32,
            ospfNbrRestartHelperExitReason
               INTEGER
            }

   ospfNbrIpAddr OBJECT-TYPE
         SYNTAX       IpAddress
         MAX-ACCESS   read-only -- read-only since originally an
                                -- SMIv1 index
         STATUS       current
         DESCRIPTION
            "The IP address this neighbor is using in its
            IP source address.  Note that, on addressless
            links, this will not be 0.0.0.0 but the
```

```
          address of another of the neighbor's interfaces."
       ::= { ospfNbrEntry 1 }

   ospfNbrAddressLessIndex OBJECT-TYPE
       SYNTAX       InterfaceIndexOrZero
       MAX-ACCESS   read-only -- read-only since originally an
                              -- SMIv1 index
       STATUS       current
       DESCRIPTION
          "On an interface having an IP address, zero.
          On addressless interfaces, the corresponding
          value of ifIndex in the Internet Standard MIB.
          On row creation, this can be derived from the
          instance."
        ::= { ospfNbrEntry 2 }

  ospfNbrRtrId OBJECT-TYPE
       SYNTAX       RouterID
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "A 32-bit integer (represented as a type
          IpAddress) uniquely identifying the neighboring
          router in the Autonomous System."
       DEFVAL { '00000000'H } -- 0.0.0.0
       ::= { ospfNbrEntry 3 }

  ospfNbrOptions OBJECT-TYPE
       SYNTAX       Integer32
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "A bit mask corresponding to the neighbor's
          options field.

          Bit 0, if set, indicates that the system will
          operate on Type of Service metrics other than
          TOS 0.  If zero, the neighbor will ignore all
          metrics except the TOS 0 metric.

          Bit 1, if set, indicates that the associated
          area accepts and operates on external
          information; if zero, it is a stub area.

          Bit 2, if set, indicates that the system is
          capable of routing IP multicast datagrams, that is
          that it implements the multicast extensions to
          OSPF.
```

```
          Bit 3, if set, indicates that the associated
          area is an NSSA.  These areas are capable of
          carrying type-7 external advertisements, which
          are translated into type-5 external advertisements
          at NSSA borders."
       REFERENCE
           "OSPF Version 2, Section 12.1.2 Options"
       DEFVAL { 0 }
       ::= { ospfNbrEntry 4 }

   ospfNbrPriority OBJECT-TYPE
       SYNTAX       DesignatedRouterPriority
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "The priority of this neighbor in the designated
          router election algorithm.  The value 0 signifies
          that the neighbor is not eligible to become
          the designated router on this particular network."

       DEFVAL { 1 }
       ::= { ospfNbrEntry 5 }

   ospfNbrState OBJECT-TYPE
        SYNTAX       INTEGER {
                         down (1),
                         attempt (2),
                         init (3),
                         twoWay (4),
                         exchangeStart (5),
                         exchange (6),
                         loading (7),
                         full (8)
                         }
         MAX-ACCESS   read-only
         STATUS       current
         DESCRIPTION
            "The state of the relationship with this neighbor."
         REFERENCE
            "OSPF Version 2, Section 10.1 Neighbor States"
         DEFVAL { down }
         ::= { ospfNbrEntry 6 }

  ospfNbrEvents OBJECT-TYPE
       SYNTAX       Counter32
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
```

```
          "The number of times this neighbor relationship
          has changed state or an error has occurred.

          Discontinuities in the value of this counter can occur
          at re-initialization of the management system, and at other
          times as indicated by the value of ospfDiscontinuityTime."
       ::= { ospfNbrEntry 7 }

  ospfNbrLsRetransQLen OBJECT-TYPE
       SYNTAX       Gauge32
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "The current length of the retransmission
          queue."
       ::= { ospfNbrEntry 8 }

  ospfNbmaNbrStatus OBJECT-TYPE
       SYNTAX       RowStatus
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "This object permits management of the table by
          facilitating actions such as row creation,
          construction, and destruction.

          The value of this object has no effect on
          whether other objects in this conceptual row can be
          modified."
       ::= { ospfNbrEntry 9 }

  ospfNbmaNbrPermanence OBJECT-TYPE
       SYNTAX       INTEGER {
                       dynamic (1), -- learned through protocol
                       permanent (2) -- configured address
                       }
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "This variable displays the status of the entry;
          'dynamic' and 'permanent' refer to how the neighbor
          became known."
       DEFVAL { permanent }
       ::= { ospfNbrEntry 10 }

   ospfNbrHelloSuppressed OBJECT-TYPE
       SYNTAX       TruthValue
       MAX-ACCESS   read-only
```

```
        STATUS       current
        DESCRIPTION
           "Indicates whether Hellos are being suppressed
           to the neighbor."
        ::= { ospfNbrEntry 11 }

  ospfNbrRestartHelperStatus OBJECT-TYPE
        SYNTAX       INTEGER { notHelping (1),
                               helping (2)
                             }
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "Indicates whether the router is acting
           as a graceful restart helper for the neighbor."
           ::= { ospfNbrEntry 12 }

  ospfNbrRestartHelperAge OBJECT-TYPE
        SYNTAX       Unsigned32
        UNITS        "seconds"
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "Remaining time in current OSPF graceful restart
           interval, if the router is acting as a restart
           helper for the neighbor."
        ::= { ospfNbrEntry 13 }

  ospfNbrRestartHelperExitReason OBJECT-TYPE
        SYNTAX       INTEGER { none (1),           -- not attempted
                               inProgress (2),     -- restart in
                                                   -- progress
                               completed (3),      -- successfully
                                                   -- completed
                               timedOut (4),       -- timed out
                               topologyChanged (5) -- aborted due to
                                                   -- topology
                                                   -- change.
                             }
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "Describes the outcome of the last attempt at acting
            as a graceful restart helper for the neighbor."
        ::= { ospfNbrEntry 14 }

--  OSPF Virtual Neighbor Table
```

```
  ospfVirtNbrTable OBJECT-TYPE
       SYNTAX       SEQUENCE OF OspfVirtNbrEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "This table describes all virtual neighbors.
          Since virtual links are configured
          in the Virtual Interface Table, this table is read-only."
       REFERENCE
          "OSPF Version 2, Section 15 Virtual Links"
       ::= { ospf 11 }

  ospfVirtNbrEntry OBJECT-TYPE
       SYNTAX       OspfVirtNbrEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "Virtual neighbor information."
       INDEX { ospfVirtNbrArea, ospfVirtNbrRtrId }
       ::= { ospfVirtNbrTable 1 }

  OspfVirtNbrEntry ::=
       SEQUENCE {
          ospfVirtNbrArea
             AreaID,
          ospfVirtNbrRtrId
             RouterID,
          ospfVirtNbrIpAddr
             IpAddress,
          ospfVirtNbrOptions
             Integer32,
          ospfVirtNbrState
             INTEGER,
          ospfVirtNbrEvents
             Counter32,
          ospfVirtNbrLsRetransQLen
             Gauge32,
          ospfVirtNbrHelloSuppressed
             TruthValue,
          ospfVirtNbrRestartHelperStatus
             INTEGER,
          ospfVirtNbrRestartHelperAge
             Unsigned32,
          ospfVirtNbrRestartHelperExitReason
             INTEGER
          }

  ospfVirtNbrArea OBJECT-TYPE
```

```
      SYNTAX       AreaID
      MAX-ACCESS   read-only -- read-only since originally an
                            -- SMIv1 index
      STATUS       current
      DESCRIPTION
         "The Transit Area Identifier."
      ::= { ospfVirtNbrEntry 1 }

  ospfVirtNbrRtrId OBJECT-TYPE
      SYNTAX       RouterID
      MAX-ACCESS   read-only -- read-only since originally an
                            -- SMIv1 index
      STATUS      current
      DESCRIPTION
         "A 32-bit integer uniquely identifying the
         neighboring router in the Autonomous System."
      ::= { ospfVirtNbrEntry 2 }

  ospfVirtNbrIpAddr OBJECT-TYPE
      SYNTAX       IpAddress
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The IP address this virtual neighbor is using."
      ::= { ospfVirtNbrEntry 3 }

  ospfVirtNbrOptions OBJECT-TYPE
      SYNTAX       Integer32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "A bit mask corresponding to the neighbor's
         options field.

         Bit 1, if set, indicates that the system will
         operate on Type of Service metrics other than
         TOS 0.  If zero, the neighbor will ignore all
         metrics except the TOS 0 metric.

         Bit 2, if set, indicates that the system is
         network multicast capable, i.e., that it
         implements OSPF multicast routing."
      ::= { ospfVirtNbrEntry 4 }

   ospfVirtNbrState OBJECT-TYPE
      SYNTAX       INTEGER {
                      down (1),
                      attempt (2),
```

```
                        init (3),
                        twoWay (4),
                        exchangeStart (5),
                        exchange (6),
                        loading (7),
                        full (8)
                        }
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The state of the virtual neighbor relationship."
      ::= { ospfVirtNbrEntry 5 }

  ospfVirtNbrEvents OBJECT-TYPE
      SYNTAX       Counter32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The number of times this virtual link has
         changed its state or an error has occurred.

         Discontinuities in the value of this counter can occur
         at re-initialization of the management system, and at other
         times as indicated by the value of ospfDiscontinuityTime."
      ::= { ospfVirtNbrEntry 6 }

  ospfVirtNbrLsRetransQLen OBJECT-TYPE
      SYNTAX       Gauge32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The current length of the retransmission
         queue."
      ::= { ospfVirtNbrEntry 7 }

  ospfVirtNbrHelloSuppressed OBJECT-TYPE
      SYNTAX       TruthValue
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "Indicates whether Hellos are being suppressed
         to the neighbor."
      ::= { ospfVirtNbrEntry 8 }

  ospfVirtNbrRestartHelperStatus OBJECT-TYPE
      SYNTAX       INTEGER { notHelping (1),
                             helping (2)
                           }
```

```
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "Indicates whether the router is acting
           as a graceful restart helper for the neighbor."
        ::= { ospfVirtNbrEntry 9 }

  ospfVirtNbrRestartHelperAge OBJECT-TYPE
        SYNTAX       Unsigned32
        UNITS        "seconds"
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "Remaining time in current OSPF graceful restart
           interval, if the router is acting as a restart
           helper for the neighbor."
        ::= { ospfVirtNbrEntry 10 }

  ospfVirtNbrRestartHelperExitReason OBJECT-TYPE
        SYNTAX       INTEGER { none (1),           -- not attempted
                               inProgress (2),     -- restart in
                                                   -- progress
                               completed (3),      -- successfully
                                                   -- completed
                               timedOut (4),       -- timed out
                               topologyChanged (5) -- aborted due to
                                                   -- topology
                                                   -- change.
                             }
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "Describes the outcome of the last attempt at acting
            as a graceful restart helper for the neighbor."
        ::= { ospfVirtNbrEntry 11 }

--  OSPF Link State Database, External

  ospfExtLsdbTable OBJECT-TYPE
        SYNTAX       SEQUENCE OF OspfExtLsdbEntry
        MAX-ACCESS   not-accessible
        STATUS       deprecated
        DESCRIPTION
           "The OSPF Process's external LSA link state database.

           This table is identical to the OSPF LSDB Table
           in format, but contains only external link state
           advertisements.  The purpose is to allow external
```

```
         LSAs to be displayed once for the router rather
         than once in each non-stub area.

         Note that external LSAs are also in the AS-scope link state
         database."
      REFERENCE
         "OSPF Version 2, Section 12 Link State Advertisements"
      ::= { ospf 12 }

  ospfExtLsdbEntry OBJECT-TYPE
      SYNTAX       OspfExtLsdbEntry
      MAX-ACCESS   not-accessible
      STATUS       deprecated
      DESCRIPTION
         "A single link state advertisement."
      INDEX { ospfExtLsdbType, ospfExtLsdbLsid, ospfExtLsdbRouterId }
      ::= { ospfExtLsdbTable 1 }

  OspfExtLsdbEntry ::=
      SEQUENCE {
         ospfExtLsdbType
            INTEGER,
         ospfExtLsdbLsid
            IpAddress,
         ospfExtLsdbRouterId
            RouterID,
         ospfExtLsdbSequence
            Integer32,
         ospfExtLsdbAge
            Integer32,
         ospfExtLsdbChecksum
            Integer32,
         ospfExtLsdbAdvertisement
            OCTET STRING
         }

  ospfExtLsdbType OBJECT-TYPE
      SYNTAX      INTEGER {
                     asExternalLink (5)
                     }
      MAX-ACCESS   read-only -- read-only since originally an
                             -- SMIv1 index
      STATUS       deprecated
      DESCRIPTION
         "The type of the link state advertisement.
         Each link state type has a separate advertisement
         format."
      REFERENCE
```

```
          "OSPF Version 2, Appendix A.4.1 The Link State
          Advertisement header"

      ::= { ospfExtLsdbEntry 1 }

  ospfExtLsdbLsid OBJECT-TYPE
       SYNTAX       IpAddress
       MAX-ACCESS   read-only -- read-only since originally an
                              -- SMIv1 index
       STATUS       deprecated
       DESCRIPTION
          "The Link State ID is an LS Type Specific field
          containing either a Router ID or an IP address;
          it identifies the piece of the routing domain
          that is being described by the advertisement."
       REFERENCE
          "OSPF Version 2, Section 12.1.4 Link State ID"
       ::= { ospfExtLsdbEntry 2 }

  ospfExtLsdbRouterId OBJECT-TYPE
       SYNTAX       RouterID
       MAX-ACCESS   read-only -- read-only since originally an
                              -- SMIv1 index
       STATUS       deprecated
       DESCRIPTION
          "The 32-bit number that uniquely identifies the
          originating router in the Autonomous System."
       REFERENCE
          "OSPF Version 2, Appendix C.1 Global parameters"
       ::= { ospfExtLsdbEntry 3 }

  ospfExtLsdbSequence OBJECT-TYPE
       SYNTAX       Integer32
       MAX-ACCESS   read-only
       STATUS       deprecated
       DESCRIPTION
          "The sequence number field is a signed 32-bit
          integer.  It starts with the value '80000001'h,
          or -'7FFFFFFF'h, and increments until '7FFFFFFF'h.
          Thus, a typical sequence number will be very negative.
          It is used to detect old and duplicate link state
          advertisements.  The space of sequence numbers is linearly
          ordered.  The larger the sequence number, the more recent
          the advertisement."
       REFERENCE
          "OSPF Version  2,  Section  12.1.6  LS  sequence
          number"
       ::= { ospfExtLsdbEntry 4 }
```

```
  ospfExtLsdbAge OBJECT-TYPE
       SYNTAX       Integer32 -- Should be 0..MaxAge, except when
                              -- doNotAge bit is set
       UNITS        "seconds"
       MAX-ACCESS   read-only
       STATUS       deprecated
       DESCRIPTION
          "This field is the age of the link state
          advertisement in seconds."
       REFERENCE
          "OSPF Version 2, Section 12.1.1 LS age"
       ::= { ospfExtLsdbEntry 5 }

  ospfExtLsdbChecksum OBJECT-TYPE
       SYNTAX       Integer32
       MAX-ACCESS   read-only
       STATUS       deprecated
       DESCRIPTION
          "This field is the checksum of the complete
          contents of the advertisement, excepting the
          age field.  The age field is excepted so that
          an advertisement's age can be incremented
          without updating the checksum.  The checksum
          used is the same that is used for ISO
          connectionless datagrams; it is commonly referred
          to as the Fletcher checksum."
       REFERENCE
          "OSPF Version 2, Section 12.1.7 LS checksum"
       ::= { ospfExtLsdbEntry 6 }

  ospfExtLsdbAdvertisement OBJECT-TYPE
       SYNTAX       OCTET STRING (SIZE(36))
       MAX-ACCESS   read-only
       STATUS       deprecated
       DESCRIPTION
          "The entire link state advertisement, including
          its header."
       REFERENCE
          "OSPF Version 2, Section 12  Link State
          Advertisements"
       ::= { ospfExtLsdbEntry 7 }

--  OSPF Use of the CIDR Route Table

  ospfRouteGroup    OBJECT IDENTIFIER ::= { ospf 13 }

--     The IP Forwarding Table defines a number of objects for use by
--     the routing protocol to externalize its information.  Most of
```

```
--     the variables (ipForwardDest, ipForwardMask, ipForwardPolicy,
--     ipForwardNextHop, ipForwardIfIndex, ipForwardType,
--     ipForwardProto, ipForwardAge, and ipForwardNextHopAS) are
--     defined there.

--     Those that leave some discretion are defined here.

--     ipCidrRouteProto is, of course, ospf (13).

--     ipCidrRouteAge is the time since the route was first
--     calculated, as opposed to the time since the last SPF run.
--     ipCidrRouteInfo is an OBJECT IDENTIFIER for use by the routing
--     protocol.  The following values shall be found there depending
--     on the way the route was calculated.

  ospfIntraArea      OBJECT IDENTIFIER ::= { ospfRouteGroup 1 }
  ospfInterArea      OBJECT IDENTIFIER ::= { ospfRouteGroup 2 }
  ospfExternalType1  OBJECT IDENTIFIER ::= { ospfRouteGroup 3 }
  ospfExternalType2  OBJECT IDENTIFIER ::= { ospfRouteGroup 4 }

--     ipCidrRouteMetric1 is, by definition, the primary routing
--     metric.  Therefore, it should be the metric that route
--     selection is based on.  For intra-area and inter-area routes,
--     it is an OSPF metric.  For External Type 1 (comparable value)
--     routes, it is an OSPF metric plus the External Metric.  For
--     external Type 2 (non-comparable value) routes, it is the
--     external metric.

--     ipCidrRouteMetric2 is, by definition, a secondary routing
--     metric.  Therefore, it should be the metric that breaks a tie
--     among routes having equal metric1 values and the same
--     calculation rule.  For intra-area, inter-area routes, and
--     External Type 1 (comparable value) routes, it is unused.  For
--     External Type 2 (non-comparable value) routes, it is the metric
--     to the AS border router.

--     ipCidrRouteMetric3, ipCidrRouteMetric4, and ipCidrRouteMetric5
--     are unused.

--  The OSPF Area Aggregate Table
--
--     This table replaces the OSPF Area Summary Table, being an
--     extension of that for CIDR routers.

   ospfAreaAggregateTable OBJECT-TYPE
       SYNTAX       SEQUENCE OF OspfAreaAggregateEntry
       MAX-ACCESS   not-accessible
       STATUS       current
```

```
      DESCRIPTION
         "The Area Aggregate Table acts as an adjunct
          to the Area Table.  It describes those address aggregates
          that are configured to be propagated from an area.
          Its purpose is to reduce the amount of information
          that is known beyond an Area's borders.

          It contains a set of IP address ranges
          specified by an IP address/IP network mask pair.
          For example, a class B address range of X.X.X.X
          with a network mask of 255.255.0.0 includes all IP
          addresses from X.X.0.0 to X.X.255.255.

          Note that if ranges are configured such that one range
          subsumes another range (e.g., 10.0.0.0 mask 255.0.0.0
          and 10.1.0.0 mask 255.255.0.0),
          the most specific match is the preferred one."
      REFERENCE
         "OSPF Version 2, Appendix C.2  Area parameters"
      ::= { ospf 14 }

  ospfAreaAggregateEntry OBJECT-TYPE
      SYNTAX   OspfAreaAggregateEntry
      MAX-ACCESS   not-accessible
      STATUS   current
      DESCRIPTION
         "A single area aggregate entry.

         Information in this table is persistent and when this object
         is written the entity SHOULD save the change to non-volatile
         storage."
      REFERENCE
         "OSPF Version 2, Appendix C.2  Area parameters"
      INDEX { ospfAreaAggregateAreaID, ospfAreaAggregateLsdbType,
         ospfAreaAggregateNet, ospfAreaAggregateMask }
      ::= { ospfAreaAggregateTable 1 }

  OspfAreaAggregateEntry ::=
      SEQUENCE {
         ospfAreaAggregateAreaID
            AreaID,
         ospfAreaAggregateLsdbType
            INTEGER,
         ospfAreaAggregateNet
            IpAddress,
         ospfAreaAggregateMask
            IpAddress,
         ospfAreaAggregateStatus
```

```
            RowStatus,
         ospfAreaAggregateEffect
            INTEGER,
         ospfAreaAggregateExtRouteTag
            Unsigned32
         }

  ospfAreaAggregateAreaID OBJECT-TYPE
       SYNTAX       AreaID
       MAX-ACCESS   read-only -- read-only since originally an
                              -- SMIv1 index
       STATUS       current
       DESCRIPTION
          "The area within which the address aggregate is to be
          found."
       REFERENCE
          "OSPF Version 2, Appendix C.2 Area parameters"
       ::= { ospfAreaAggregateEntry 1 }

  ospfAreaAggregateLsdbType OBJECT-TYPE
       SYNTAX       INTEGER {
                       summaryLink (3),
                       nssaExternalLink (7)
                       }
       MAX-ACCESS   read-only -- read-only since originally an
                              -- SMIv1 index
       STATUS       current
       DESCRIPTION
          "The type of the address aggregate.  This field
          specifies the Lsdb type that this address
          aggregate applies to."
       REFERENCE
          "OSPF Version 2, Appendix A.4.1 The Link State
          Advertisement header"
       ::= { ospfAreaAggregateEntry 2 }

  ospfAreaAggregateNet OBJECT-TYPE
       SYNTAX   IpAddress
       MAX-ACCESS   read-only -- read-only since originally an
                              -- SMIv1 index
       STATUS   current
       DESCRIPTION
          "The IP address of the net or subnet indicated
          by the range."
       REFERENCE
          "OSPF Version 2, Appendix C.2 Area parameters"
       ::= { ospfAreaAggregateEntry 3 }
```

```
  ospfAreaAggregateMask OBJECT-TYPE
       SYNTAX       IpAddress
       MAX-ACCESS   read-only -- read-only since originally an
                              -- SMIv1 index
       STATUS      current
       DESCRIPTION
          "The subnet mask that pertains to the net or
          subnet."
       REFERENCE
          "OSPF Version 2, Appendix C.2 Area parameters"
       ::= { ospfAreaAggregateEntry 4 }

  ospfAreaAggregateStatus OBJECT-TYPE
       SYNTAX       RowStatus
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "This object permits management of the table by
          facilitating actions such as row creation,
          construction, and destruction.

          The value of this object has no effect on
          whether other objects in this conceptual row can be
          modified."
       ::= { ospfAreaAggregateEntry 5 }

  ospfAreaAggregateEffect OBJECT-TYPE
       SYNTAX       INTEGER {
                       advertiseMatching (1),
                       doNotAdvertiseMatching (2)
                       }
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "Subnets subsumed by ranges either trigger the
          advertisement of the indicated aggregate
         (advertiseMatching) or result in the subnet's not
          being advertised at all outside the area."
       DEFVAL { advertiseMatching }
       ::= { ospfAreaAggregateEntry 6 }

  ospfAreaAggregateExtRouteTag OBJECT-TYPE
       SYNTAX       Unsigned32
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "External route tag to be included in NSSA (type-7)
           LSAs."
```

```
       DEFVAL { 0 }
       ::= { ospfAreaAggregateEntry 7 }

--  OSPF Link State Database, link-local for non-virtual links


  ospfLocalLsdbTable OBJECT-TYPE
       SYNTAX       SEQUENCE OF OspfLocalLsdbEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "The OSPF Process's link-local link state database
          for non-virtual links.
          This table is identical to the OSPF LSDB Table
          in format, but contains only link-local Link State
          Advertisements for non-virtual links.  The purpose is
          to allow link-local LSAs to be displayed for each
          non-virtual interface.  This table is implemented to
          support type-9 LSAs that are defined
          in 'The OSPF Opaque LSA Option'."
       REFERENCE
          "OSPF Version 2, Section 12 Link State Advertisements
          and The OSPF Opaque LSA Option"
       ::= { ospf 17 }

  ospfLocalLsdbEntry OBJECT-TYPE
       SYNTAX       OspfLocalLsdbEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "A single link state advertisement."
       INDEX { ospfLocalLsdbIpAddress, ospfLocalLsdbAddressLessIf,
          ospfLocalLsdbType, ospfLocalLsdbLsid, ospfLocalLsdbRouterId
          }
       ::= { ospfLocalLsdbTable 1 }

  OspfLocalLsdbEntry ::=
       SEQUENCE {
          ospfLocalLsdbIpAddress
             IpAddress,
          ospfLocalLsdbAddressLessIf
             InterfaceIndexOrZero,
          ospfLocalLsdbType
             INTEGER,
          ospfLocalLsdbLsid
             IpAddress,
          ospfLocalLsdbRouterId
             RouterID,
```

```
          ospfLocalLsdbSequence
             Integer32,
          ospfLocalLsdbAge
             Integer32,
          ospfLocalLsdbChecksum
             Integer32,
          ospfLocalLsdbAdvertisement
             OCTET STRING
          }

  ospfLocalLsdbIpAddress OBJECT-TYPE
       SYNTAX       IpAddress
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "The IP address of the interface from
          which the LSA was received if the interface is
          numbered."
       REFERENCE
          "OSPF Version 2, Appendix C.3 Interface parameters"
       ::= { ospfLocalLsdbEntry 1 }

  ospfLocalLsdbAddressLessIf OBJECT-TYPE
       SYNTAX       InterfaceIndexOrZero
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "The interface index of the interface from
          which the LSA was received if the interface is
          unnumbered."
       REFERENCE
          "OSPF Version 2, Appendix C.3 Interface parameters"
       ::= { ospfLocalLsdbEntry 2 }

  ospfLocalLsdbType OBJECT-TYPE
       SYNTAX       INTEGER { localOpaqueLink (9) }
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "The type of the link state advertisement.
          Each link state type has a separate
          advertisement format."
       REFERENCE
          "OSPF Version 2, Appendix A.4.1 The Link State
          Advertisement header"
       ::= { ospfLocalLsdbEntry 3 }

  ospfLocalLsdbLsid OBJECT-TYPE
```

```
        SYNTAX       IpAddress
        MAX-ACCESS   not-accessible
        STATUS       current
        DESCRIPTION
           "The Link State ID is an LS Type Specific field
           containing a 32-bit identifier in IP address format;
           it identifies the piece of the routing domain
           that is being described by the advertisement."
        REFERENCE
          "OSPF Version 2, Section 12.1.4 Link State ID"
        ::= { ospfLocalLsdbEntry 4 }

    ospfLocalLsdbRouterId OBJECT-TYPE
        SYNTAX       RouterID
        MAX-ACCESS   not-accessible
        STATUS       current
        DESCRIPTION
           "The 32-bit number that uniquely identifies the
           originating router in the Autonomous System."
        REFERENCE
           "OSPF Version 2, Appendix C.1 Global parameters"
        ::= { ospfLocalLsdbEntry 5 }

    ospfLocalLsdbSequence OBJECT-TYPE
        SYNTAX       Integer32
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "The sequence number field is a signed 32-bit
           integer.  It starts with the value '80000001'h,
           or -'7FFFFFFF'h, and increments until '7FFFFFFF'h.
           Thus, a typical sequence number will be very negative.
           It is used to detect old and duplicate link state
           advertisements.  The space of sequence numbers is linearly
           ordered.  The larger the sequence number, the more recent
           the advertisement."
        REFERENCE
           "OSPF Version 2, Section 12.1.6 LS sequence
           number"
        ::= { ospfLocalLsdbEntry 6 }

    ospfLocalLsdbAge OBJECT-TYPE
        SYNTAX       Integer32 -- Should be 0..MaxAge, except when
                               -- doNotAge bit is set
        UNITS        "seconds"
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
```

```
          "This field is the age of the link state
          advertisement in seconds."
       REFERENCE
          "OSPF Version 2, Section 12.1.1 LS age"
       ::= { ospfLocalLsdbEntry 7 }

  ospfLocalLsdbChecksum OBJECT-TYPE
       SYNTAX       Integer32
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "This field is the checksum of the complete
          contents of the advertisement, excepting the
          age field.  The age field is excepted so that
          an advertisement's age can be incremented
          without updating the checksum.  The checksum
          used is the same that is used for ISO
          connectionless datagrams; it is commonly referred
          to as the Fletcher checksum."
       REFERENCE
          "OSPF Version 2, Section 12.1.7 LS checksum"
       ::= { ospfLocalLsdbEntry 8 }

  ospfLocalLsdbAdvertisement OBJECT-TYPE
       SYNTAX       OCTET STRING (SIZE (1..65535))
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "The entire link state advertisement, including
          its header.

          Note that for variable length LSAs, SNMP agents
          may not be able to return the largest string size."
       REFERENCE
          "OSPF Version 2, Section 12 Link State
          Advertisements"
       ::= { ospfLocalLsdbEntry 9 }

--  OSPF Link State Database, link-local for virtual Links

  ospfVirtLocalLsdbTable OBJECT-TYPE
       SYNTAX       SEQUENCE OF OspfVirtLocalLsdbEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "The OSPF Process's link-local link state database
          for virtual links.
```

```
          This table is identical to the OSPF LSDB Table
          in format, but contains only link-local Link State
          Advertisements for virtual links.  The purpose is to
          allow link-local LSAs to be displayed for each virtual
          interface.  This table is implemented to support type-9 LSAs
          that are defined in 'The OSPF Opaque LSA Option'."
       REFERENCE
          "OSPF Version 2, Section 12 Link State
          Advertisements and The OSPF Opaque LSA Option"
       ::= { ospf 18 }

  ospfVirtLocalLsdbEntry OBJECT-TYPE
       SYNTAX       OspfVirtLocalLsdbEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "A single link state advertisement."
       INDEX { ospfVirtLocalLsdbTransitArea,
          ospfVirtLocalLsdbNeighbor,
          ospfVirtLocalLsdbType,
          ospfVirtLocalLsdbLsid,
          ospfVirtLocalLsdbRouterId
          }
       ::= { ospfVirtLocalLsdbTable 1 }

  OspfVirtLocalLsdbEntry ::=
       SEQUENCE {
          ospfVirtLocalLsdbTransitArea
             AreaID,
          ospfVirtLocalLsdbNeighbor
             RouterID,
          ospfVirtLocalLsdbType
             INTEGER,
          ospfVirtLocalLsdbLsid
             IpAddress,
          ospfVirtLocalLsdbRouterId
             RouterID,
          ospfVirtLocalLsdbSequence
             Integer32,
          ospfVirtLocalLsdbAge
             Integer32,
          ospfVirtLocalLsdbChecksum
             Integer32,
          ospfVirtLocalLsdbAdvertisement
            OCTET STRING
          }

  ospfVirtLocalLsdbTransitArea OBJECT-TYPE
```

```
      SYNTAX       AreaID
      MAX-ACCESS   not-accessible
      STATUS       current
      DESCRIPTION
         "The transit area that the virtual link
         traverses.  By definition, this is not 0.0.0.0."
      REFERENCE
         "OSPF Version 2, Appendix C.3 Interface parameters"
      ::= { ospfVirtLocalLsdbEntry 1 }

  ospfVirtLocalLsdbNeighbor OBJECT-TYPE
      SYNTAX       RouterID
      MAX-ACCESS   not-accessible
      STATUS       current
      DESCRIPTION
         "The Router ID of the virtual neighbor."
      REFERENCE
         "OSPF Version 2, Appendix C.3 Interface parameters"
      ::= { ospfVirtLocalLsdbEntry 2 }

  ospfVirtLocalLsdbType OBJECT-TYPE
      SYNTAX       INTEGER  { localOpaqueLink (9) }
      MAX-ACCESS   not-accessible
      STATUS       current
      DESCRIPTION
         "The type of the link state advertisement.
         Each link state type has a separate
         advertisement format."
      REFERENCE
         "OSPF Version 2, Appendix A.4.1 The Link State
         Advertisement header"
      ::= { ospfVirtLocalLsdbEntry 3 }

  ospfVirtLocalLsdbLsid OBJECT-TYPE
      SYNTAX       IpAddress
      MAX-ACCESS   not-accessible
      STATUS       current
      DESCRIPTION
         "The Link State ID is an LS Type Specific field
         containing a 32-bit identifier in IP address format;
         it identifies the piece of the routing domain
         that is being described by the advertisement."
      REFERENCE
         "OSPF Version 2, Section 12.1.4 Link State ID"
      ::= { ospfVirtLocalLsdbEntry 4 }

  ospfVirtLocalLsdbRouterId OBJECT-TYPE
      SYNTAX       RouterID
```

```
      MAX-ACCESS   not-accessible
      STATUS       current
      DESCRIPTION
         "The 32-bit number that uniquely identifies the
         originating router in the Autonomous System."
      REFERENCE
         "OSPF Version 2, Appendix C.1 Global parameters"
      ::= { ospfVirtLocalLsdbEntry 5 }

  ospfVirtLocalLsdbSequence OBJECT-TYPE
      SYNTAX       Integer32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The sequence number field is a signed 32-bit
         integer.  It starts with the value '80000001'h,
         or -'7FFFFFFF'h, and increments until '7FFFFFFF'h.
         Thus, a typical sequence number will be very negative.
         It is used to detect old and duplicate link state
         advertisements.  The space of sequence numbers is linearly
         ordered.  The larger the sequence number, the more recent
         the advertisement."
      REFERENCE
         "OSPF Version 2, Section 12.1.6 LS sequence
         number"
      ::= { ospfVirtLocalLsdbEntry 6 }

  ospfVirtLocalLsdbAge OBJECT-TYPE
      SYNTAX       Integer32 -- Should be 0..MaxAge, except when
                             -- doNotAge bit is set
      UNITS        "seconds"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "This field is the age of the link state
         advertisement in seconds."
      REFERENCE
         "OSPF Version 2, Section 12.1.1 LS age"
      ::= { ospfVirtLocalLsdbEntry 7 }

  ospfVirtLocalLsdbChecksum OBJECT-TYPE
      SYNTAX       Integer32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "This field is the checksum of the complete
         contents of the advertisement, excepting the
         age field.  The age field is excepted so that
```

```
            an advertisement's age can be incremented
            without updating the checksum.  The checksum
            used is the same that is used for ISO
            connectionless datagrams; it is commonly
            referred to as the Fletcher checksum."
         REFERENCE
            "OSPF Version 2, Section 12.1.7 LS checksum"
         ::= { ospfVirtLocalLsdbEntry 8 }

   ospfVirtLocalLsdbAdvertisement OBJECT-TYPE
         SYNTAX       OCTET STRING (SIZE (1..65535))
         MAX-ACCESS   read-only
         STATUS       current
         DESCRIPTION
            "The entire link state advertisement, including
            its header."
         REFERENCE
            "OSPF Version 2, Section 12 Link State
            Advertisements.

            Note that for variable length LSAs, SNMP agents
            may not be able to return the largest string size."
         ::= { ospfVirtLocalLsdbEntry 9 }

--  OSPF Link State Database, AS-scope

   ospfAsLsdbTable OBJECT-TYPE
         SYNTAX       SEQUENCE OF OspfAsLsdbEntry
         MAX-ACCESS   not-accessible
         STATUS       current
         DESCRIPTION
            "The OSPF Process's AS-scope LSA link state database.
             The database contains the AS-scope Link State
             Advertisements from throughout the areas that
             the device is attached to.

             This table is identical to the OSPF LSDB Table
             in format, but contains only AS-scope Link State
             Advertisements.  The purpose is to allow AS-scope
             LSAs to be displayed once for the router rather
             than once in each non-stub area."
         REFERENCE
            "OSPF Version 2, Section 12 Link State
            Advertisements"
         ::= { ospf 19 }

   ospfAsLsdbEntry OBJECT-TYPE
         SYNTAX       OspfAsLsdbEntry
```

```
      MAX-ACCESS   not-accessible
      STATUS       current
      DESCRIPTION
         "A single link state advertisement."
      INDEX { ospfAsLsdbType, ospfAsLsdbLsid, ospfAsLsdbRouterId }
      ::= { ospfAsLsdbTable 1 }

  OspfAsLsdbEntry ::=
      SEQUENCE {
         ospfAsLsdbType
            INTEGER,
         ospfAsLsdbLsid
            IpAddress,
         ospfAsLsdbRouterId
            RouterID,
         ospfAsLsdbSequence
            Integer32,
         ospfAsLsdbAge
            Integer32,
         ospfAsLsdbChecksum
            Integer32,
         ospfAsLsdbAdvertisement
            OCTET STRING
         }

  ospfAsLsdbType OBJECT-TYPE
      SYNTAX      INTEGER {
                     asExternalLink (5),
                     asOpaqueLink   (11)
                     }
      MAX-ACCESS   not-accessible
      STATUS       current
      DESCRIPTION
         "The type of the link state advertisement.
         Each link state type has a separate
         advertisement format."
      REFERENCE
         "OSPF Version 2, Appendix A.4.1 The Link State
         Advertisement header"
      ::= { ospfAsLsdbEntry 1 }

  ospfAsLsdbLsid OBJECT-TYPE
      SYNTAX       IpAddress
      MAX-ACCESS   not-accessible
      STATUS       current
      DESCRIPTION
         "The Link State ID is an LS Type Specific field
         containing either a Router ID or an IP address;
```

```
         it identifies the piece of the routing domain
         that is being described by the advertisement."
      REFERENCE
         "OSPF Version 2, Section 12.1.4 Link State ID"
      ::= { ospfAsLsdbEntry 2 }

  ospfAsLsdbRouterId OBJECT-TYPE
      SYNTAX       RouterID
      MAX-ACCESS   not-accessible
      STATUS       current
      DESCRIPTION
         "The 32-bit number that uniquely identifies the
         originating router in the Autonomous System."
      REFERENCE
         "OSPF Version 2, Appendix C.1 Global parameters"
      ::= { ospfAsLsdbEntry 3 }

  ospfAsLsdbSequence OBJECT-TYPE
      SYNTAX       Integer32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The sequence number field is a signed 32-bit
         integer.  It starts with the value '80000001'h,
         or -'7FFFFFFF'h, and increments until '7FFFFFFF'h.
         Thus, a typical sequence number will be very negative.
         It is used to detect old and duplicate link state
         advertisements.  The space of sequence numbers is linearly
         ordered.  The larger the sequence number, the more recent
         the advertisement."
      REFERENCE
         "OSPF Version  2,  Section  12.1.6  LS  sequence
         number"
      ::= { ospfAsLsdbEntry 4 }

  ospfAsLsdbAge OBJECT-TYPE
      SYNTAX       Integer32 -- Should be 0..MaxAge, except when
                             -- doNotAge bit is set
      UNITS        "seconds"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "This field is the age of the link state
         advertisement in seconds."
      REFERENCE
         "OSPF Version 2, Section 12.1.1 LS age"
      ::= { ospfAsLsdbEntry 5 }
```

```
  ospfAsLsdbChecksum OBJECT-TYPE
       SYNTAX       Integer32
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "This field is the checksum of the complete
          contents of the advertisement, excepting the
          age field.  The age field is excepted so that
          an advertisement's age can be incremented
          without updating the checksum.  The checksum
          used is the same that is used for ISO
          connectionless datagrams; it is commonly referred
          to as the Fletcher checksum."
       REFERENCE
          "OSPF Version 2, Section 12.1.7 LS checksum"
       ::= { ospfAsLsdbEntry 6 }

  ospfAsLsdbAdvertisement OBJECT-TYPE
       SYNTAX       OCTET STRING (SIZE (1..65535))
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "The entire link state advertisement, including
          its header."
       REFERENCE
          "OSPF Version 2, Section 12 Link State
          Advertisements.

          Note that for variable length LSAs, SNMP agents
          may not be able to return the largest string size."
       ::= { ospfAsLsdbEntry 7 }

 --  OSPF Area LSA Counter Table

      ospfAreaLsaCountTable OBJECT-TYPE
          SYNTAX       SEQUENCE OF OspfAreaLsaCountEntry
          MAX-ACCESS   not-accessible
          STATUS       current
          DESCRIPTION
             "This table maintains per-area, per-LSA-type counters"
          ::= { ospf 20 }

      ospfAreaLsaCountEntry OBJECT-TYPE
          SYNTAX       OspfAreaLsaCountEntry
          MAX-ACCESS   not-accessible
          STATUS       current
          DESCRIPTION
             "An entry with a number of link advertisements
```

```
            of a given type for a given area."
        INDEX { ospfAreaLsaCountAreaId, ospfAreaLsaCountLsaType }
        ::= { ospfAreaLsaCountTable 1 }

    OspfAreaLsaCountEntry ::=
         SEQUENCE {
            ospfAreaLsaCountAreaId
               AreaID,
            ospfAreaLsaCountLsaType
               INTEGER,
            ospfAreaLsaCountNumber
               Gauge32
         }

    ospfAreaLsaCountAreaId OBJECT-TYPE
        SYNTAX       AreaID
        MAX-ACCESS   not-accessible
        STATUS       current
        DESCRIPTION
           "This entry Area ID."
       ::= { ospfAreaLsaCountEntry 1 }

    ospfAreaLsaCountLsaType OBJECT-TYPE
        SYNTAX       INTEGER {
                        routerLink (1),
                        networkLink (2),
                        summaryLink (3),
                        asSummaryLink (4),
                        multicastLink (6),
                        nssaExternalLink (7),
                        areaOpaqueLink (10)
                     }
        MAX-ACCESS   not-accessible
        STATUS       current
        DESCRIPTION
           "This entry LSA type."
       ::= { ospfAreaLsaCountEntry 2 }

    ospfAreaLsaCountNumber OBJECT-TYPE
        SYNTAX       Gauge32
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "Number of LSAs of a given type for a given area."
       ::= { ospfAreaLsaCountEntry 3 }

-- conformance information
```

```
ospfConformance OBJECT IDENTIFIER ::= { ospf 15 }

ospfGroups      OBJECT IDENTIFIER ::= { ospfConformance 1 }
ospfCompliances OBJECT IDENTIFIER ::= { ospfConformance 2 }

-- compliance statements

  ospfCompliance MODULE-COMPLIANCE
       STATUS       deprecated
       DESCRIPTION
          "The compliance statement for OSPF systems
          conforming to RFC 1850."
       MODULE       -- this module
       MANDATORY-GROUPS {
           ospfBasicGroup,
           ospfAreaGroup,
           ospfStubAreaGroup,
           ospfIfGroup,
           ospfIfMetricGroup,
           ospfVirtIfGroup,
           ospfNbrGroup,
           ospfVirtNbrGroup,
           ospfAreaAggregateGroup
           }
       GROUP  ospfHostGroup
          DESCRIPTION
             "This group is mandatory for OSPF systems that support
             attached hosts."
       GROUP  ospfLsdbGroup
          DESCRIPTION
             "This group is mandatory for OSPF systems that display
             their per-area link state database."
       GROUP  ospfExtLsdbGroup
          DESCRIPTION
             "This group is mandatory for OSPF systems that display
             their external link state database."
       ::= { ospfCompliances 1 }

  ospfCompliance2 MODULE-COMPLIANCE
       STATUS       current
       DESCRIPTION
          "The compliance statement."
       MODULE       -- this module
       MANDATORY-GROUPS {
          ospfBasicGroup2,
          ospfAreaGroup2,
          ospfStubAreaGroup,
          ospfIfGroup2,
```

```
          ospfIfMetricGroup,
          ospfVirtIfGroup2,
          ospfNbrGroup2,
          ospfVirtNbrGroup2,
          ospfAreaAggregateGroup2
          }
       GROUP  ospfHostGroup2
          DESCRIPTION
             "This group is mandatory for OSPF systems that support
             attached hosts."
       GROUP  ospfLsdbGroup
          DESCRIPTION
             "This group is mandatory for OSPF systems that display
             their per-area link state database."
       GROUP  ospfAsLsdbGroup
          DESCRIPTION
             "This group is mandatory for OSPF systems that display
             their AS-scope link state database."
       GROUP  ospfLocalLsdbGroup
          DESCRIPTION
             "This group is mandatory for OSPF systems that display
             their per-link link state database for non-virtual
             links."
       GROUP  ospfVirtLocalLsdbGroup
          DESCRIPTION
             "This group is mandatory for OSPF systems that display
             their per-link link state database for virtual links."
       GROUP ospfAreaLsaCountGroup
          DESCRIPTION
             "This group is mandatory for OSPF systems that display
             per-area, per-LSA-type counters."
       ::= { ospfCompliances 2 }

  ospfComplianceObsolete MODULE-COMPLIANCE
       STATUS       obsolete
       DESCRIPTION
          "Contains obsolete object groups."
       MODULE       -- this module
       GROUP  ospfAreaRangeGroup
          DESCRIPTION
             "This group is obsolete, and it is mandatory only
             for non-Classless Inter-Domain Routing (CIDR) OSPF
             systems that support multiple areas."
       GROUP  ospfObsoleteGroup
          DESCRIPTION
             "This group contains obsolete objects,
             which are no longer required for OSPF systems."
       ::= { ospfCompliances 3 }
```

```
--  units of conformance

  ospfBasicGroup    OBJECT-GROUP
       OBJECTS {
          ospfRouterId,
          ospfAdminStat,
          ospfVersionNumber,
          ospfAreaBdrRtrStatus,
          ospfASBdrRtrStatus,
          ospfExternLsaCount,
          ospfExternLsaCksumSum,
          ospfTOSSupport,
          ospfOriginateNewLsas,
          ospfRxNewLsas,
          ospfExtLsdbLimit,
          ospfMulticastExtensions,
          ospfExitOverflowInterval,
          ospfDemandExtensions
          }
       STATUS      deprecated
       DESCRIPTION
          "These objects are used to monitor/manage
          global OSPF parameters.  This object group
          conforms to RFC 1850."
       ::= { ospfGroups 1 }

  ospfAreaGroup    OBJECT-GROUP
       OBJECTS {
          ospfAreaId,
          ospfImportAsExtern,
          ospfSpfRuns,
          ospfAreaBdrRtrCount,
          ospfAsBdrRtrCount,
          ospfAreaLsaCount,
          ospfAreaLsaCksumSum,
          ospfAreaSummary,
          ospfAreaStatus
          }
       STATUS      deprecated
       DESCRIPTION
          "These objects are used for OSPF systems
          supporting areas per RFC 1850."
       ::= { ospfGroups 2 }

  ospfStubAreaGroup    OBJECT-GROUP
       OBJECTS {
          ospfStubAreaId,
          ospfStubTOS,
```

```
          ospfStubMetric,
          ospfStubStatus,
          ospfStubMetricType
          }
       STATUS       current
       DESCRIPTION
          "These objects are used for OSPF systems
          supporting stub areas."
       ::= { ospfGroups 3 }

   ospfLsdbGroup    OBJECT-GROUP
       OBJECTS {
          ospfLsdbAreaId,
          ospfLsdbType,
          ospfLsdbLsid,
          ospfLsdbRouterId,
          ospfLsdbSequence,
          ospfLsdbAge,
          ospfLsdbChecksum,
          ospfLsdbAdvertisement
          }
       STATUS       current
       DESCRIPTION
          "These objects are used for OSPF systems
          that display their link state database."
       ::= { ospfGroups 4 }

   ospfAreaRangeGroup    OBJECT-GROUP
       OBJECTS {
          ospfAreaRangeAreaId,
          ospfAreaRangeNet,
          ospfAreaRangeMask,
          ospfAreaRangeStatus,
          ospfAreaRangeEffect
          }
       STATUS  obsolete
       DESCRIPTION
          "These objects are used for non-CIDR OSPF
          systems that support multiple areas.  This
          object group is obsolete."
       ::= { ospfGroups 5 }

  ospfHostGroup    OBJECT-GROUP
       OBJECTS {
          ospfHostIpAddress,
          ospfHostTOS,
          ospfHostMetric,
          ospfHostStatus,
```

```
          ospfHostAreaID
          }
      STATUS       deprecated
      DESCRIPTION
          "These objects are used for OSPF systems
          that support attached hosts."
      ::= { ospfGroups 6 }

  ospfIfGroup    OBJECT-GROUP
      OBJECTS {
          ospfIfIpAddress,
          ospfAddressLessIf,
          ospfIfAreaId,
          ospfIfType,
          ospfIfAdminStat,
          ospfIfRtrPriority,
          ospfIfTransitDelay,
          ospfIfRetransInterval,
          ospfIfHelloInterval,
          ospfIfRtrDeadInterval,
          ospfIfPollInterval,
          ospfIfState,
          ospfIfDesignatedRouter,
          ospfIfBackupDesignatedRouter,
          ospfIfEvents,
          ospfIfAuthType,
          ospfIfAuthKey,
          ospfIfStatus,
          ospfIfMulticastForwarding,
          ospfIfDemand
          }
      STATUS       deprecated
      DESCRIPTION
          "These objects are used to monitor/manage OSPF
          interfaces.  This object group conforms to RFC 1850."
      ::= { ospfGroups 7 }

  ospfIfMetricGroup    OBJECT-GROUP
      OBJECTS {
          ospfIfMetricIpAddress,
          ospfIfMetricAddressLessIf,
          ospfIfMetricTOS,
          ospfIfMetricValue,
          ospfIfMetricStatus
          }
      STATUS       current
      DESCRIPTION
          "These objects are used for OSPF systems for supporting
```

```
          interface metrics."
       ::= { ospfGroups 8 }

  ospfVirtIfGroup    OBJECT-GROUP
       OBJECTS {
          ospfVirtIfAreaId,
          ospfVirtIfNeighbor,
          ospfVirtIfTransitDelay,
          ospfVirtIfRetransInterval,
          ospfVirtIfHelloInterval,
          ospfVirtIfRtrDeadInterval,
          ospfVirtIfState,
          ospfVirtIfEvents,
          ospfVirtIfAuthType,
          ospfVirtIfAuthKey,
          ospfVirtIfStatus
          }
        STATUS       deprecated
        DESCRIPTION
          "These objects are used for OSPF systems for supporting
          virtual interfaces.  This object group conforms
          to RFC 1850."
        ::= { ospfGroups 9 }

  ospfNbrGroup    OBJECT-GROUP
       OBJECTS {
          ospfNbrIpAddr,
          ospfNbrAddressLessIndex,
          ospfNbrRtrId,
          ospfNbrOptions,
          ospfNbrPriority,
          ospfNbrState,
          ospfNbrEvents,
          ospfNbrLsRetransQLen,
          ospfNbmaNbrStatus,
          ospfNbmaNbrPermanence,
          ospfNbrHelloSuppressed
          }
       STATUS       deprecated
       DESCRIPTION
          "These objects are used to monitor/manage OSPF neighbors.
          This object group conforms to RFC 1850."
       ::= { ospfGroups 10 }

  ospfVirtNbrGroup    OBJECT-GROUP
       OBJECTS {
          ospfVirtNbrArea,
          ospfVirtNbrRtrId,
```

```
          ospfVirtNbrIpAddr,
          ospfVirtNbrOptions,
          ospfVirtNbrState,
          ospfVirtNbrEvents,
          ospfVirtNbrLsRetransQLen,
          ospfVirtNbrHelloSuppressed
          }
      STATUS       deprecated
      DESCRIPTION
         "These objects are used to monitor/manage OSPF virtual
         neighbors.  This object group conforms to RFC 1850."

      ::= { ospfGroups 11 }

  ospfExtLsdbGroup    OBJECT-GROUP
      OBJECTS {
         ospfExtLsdbType,
         ospfExtLsdbLsid,
         ospfExtLsdbRouterId,
         ospfExtLsdbSequence,
         ospfExtLsdbAge,
         ospfExtLsdbChecksum,
         ospfExtLsdbAdvertisement
         }
      STATUS       deprecated
      DESCRIPTION
         "These objects are used for OSPF systems that display
         their link state database.  This object group
         conforms to RFC 1850.

         This object group is replaced by the ospfAsLsdbGroup
         in order to support any AS-scope LSA type in a single
         table."
      ::= { ospfGroups 12 }

  ospfAreaAggregateGroup    OBJECT-GROUP
      OBJECTS {
         ospfAreaAggregateAreaID,
         ospfAreaAggregateLsdbType,
         ospfAreaAggregateNet,
         ospfAreaAggregateMask,
         ospfAreaAggregateStatus,
         ospfAreaAggregateEffect
         }
      STATUS       deprecated
      DESCRIPTION
         "These objects are used for OSPF systems to support
         network prefix aggregation across areas."
```

```
      ::= { ospfGroups 13 }

  ospfLocalLsdbGroup    OBJECT-GROUP
       OBJECTS {
          ospfLocalLsdbSequence,
          ospfLocalLsdbAge,
          ospfLocalLsdbChecksum,
          ospfLocalLsdbAdvertisement
          }
       STATUS      current
       DESCRIPTION
          "These objects are used for OSPF systems
          that display their link-local link state databases
          for non-virtual links."
        ::= { ospfGroups 14 }

  ospfVirtLocalLsdbGroup    OBJECT-GROUP
       OBJECTS {
          ospfVirtLocalLsdbSequence,
          ospfVirtLocalLsdbAge,
          ospfVirtLocalLsdbChecksum,
          ospfVirtLocalLsdbAdvertisement
          }
        STATUS       current
        DESCRIPTION
           "These objects are used for OSPF systems
           that display their link-local link state databases
           for virtual links."
         ::= { ospfGroups 15 }

  ospfAsLsdbGroup    OBJECT-GROUP
       OBJECTS {
          ospfAsLsdbSequence,
          ospfAsLsdbAge,
          ospfAsLsdbChecksum,
          ospfAsLsdbAdvertisement
          }
        STATUS       current
        DESCRIPTION
           "These objects are used for OSPF systems
           that display their AS-scope link state database."
         ::= { ospfGroups 16 }

  ospfBasicGroup2    OBJECT-GROUP
       OBJECTS {
          ospfRouterId,
          ospfAdminStat,
          ospfVersionNumber,
```

```
          ospfAreaBdrRtrStatus,
          ospfASBdrRtrStatus,
          ospfExternLsaCount,
          ospfExternLsaCksumSum,
          ospfTOSSupport,
          ospfOriginateNewLsas,
          ospfRxNewLsas,
          ospfExtLsdbLimit,
          ospfMulticastExtensions,
          ospfExitOverflowInterval,
          ospfDemandExtensions,
          ospfRFC1583Compatibility,
          ospfOpaqueLsaSupport,
          ospfReferenceBandwidth,
          ospfRestartSupport,
          ospfRestartInterval,
          ospfRestartStrictLsaChecking,
          ospfRestartStatus,
          ospfRestartAge,
          ospfRestartExitReason,
          ospfAsLsaCount,
          ospfAsLsaCksumSum,
          ospfStubRouterSupport,
          ospfStubRouterAdvertisement,
          ospfDiscontinuityTime
          }
      STATUS       current
      DESCRIPTION
          "These objects are used to monitor/manage OSPF global
          parameters."
      ::= { ospfGroups 17 }

  ospfAreaGroup2    OBJECT-GROUP
      OBJECTS {
          ospfAreaId,
          ospfImportAsExtern,
          ospfSpfRuns,
          ospfAreaBdrRtrCount,
          ospfAsBdrRtrCount,
          ospfAreaLsaCount,
          ospfAreaLsaCksumSum,
          ospfAreaSummary,
          ospfAreaStatus,
          ospfAreaNssaTranslatorRole,
          ospfAreaNssaTranslatorState,
          ospfAreaNssaTranslatorStabilityInterval,
          ospfAreaNssaTranslatorEvents
          }
```

```
       STATUS       current
       DESCRIPTION
            "These objects are used by OSPF systems
            to support areas."
       ::= { ospfGroups 18 }

  ospfIfGroup2    OBJECT-GROUP
       OBJECTS {
          ospfIfIpAddress,
          ospfAddressLessIf,
          ospfIfAreaId,
          ospfIfType,
          ospfIfAdminStat,
          ospfIfRtrPriority,
          ospfIfTransitDelay,
          ospfIfRetransInterval,
          ospfIfHelloInterval,
          ospfIfRtrDeadInterval,
          ospfIfPollInterval,
          ospfIfState,
          ospfIfDesignatedRouter,
          ospfIfBackupDesignatedRouter,
          ospfIfEvents,
          ospfIfAuthType,
          ospfIfAuthKey,
          ospfIfStatus,
          ospfIfMulticastForwarding,
          ospfIfDemand,
          ospfIfLsaCount,
          ospfIfLsaCksumSum
          }
       STATUS       current
       DESCRIPTION
          "These objects are used to monitor/manage OSPF interfaces."
        ::= { ospfGroups 19 }

  ospfVirtIfGroup2    OBJECT-GROUP
       OBJECTS {
          ospfVirtIfAreaId,
          ospfVirtIfNeighbor,
          ospfVirtIfTransitDelay,
          ospfVirtIfRetransInterval,
          ospfVirtIfHelloInterval,
          ospfVirtIfRtrDeadInterval,
          ospfVirtIfState,
          ospfVirtIfEvents,
          ospfVirtIfAuthType,
          ospfVirtIfAuthKey,
```

```
          ospfVirtIfStatus,
          ospfVirtIfLsaCount,
          ospfVirtIfLsaCksumSum,
          ospfIfDesignatedRouterId,
          ospfIfBackupDesignatedRouterId
          }
      STATUS       current
      DESCRIPTION
          "These objects are used to monitor/manage OSPF
          virtual interfaces."
      ::= { ospfGroups 20 }

  ospfNbrGroup2    OBJECT-GROUP
      OBJECTS {
          ospfNbrIpAddr,
          ospfNbrAddressLessIndex,
          ospfNbrRtrId,
          ospfNbrOptions,
          ospfNbrPriority,
          ospfNbrState,
          ospfNbrEvents,
          ospfNbrLsRetransQLen,
          ospfNbmaNbrStatus,
          ospfNbmaNbrPermanence,
          ospfNbrHelloSuppressed,
          ospfNbrRestartHelperStatus,
          ospfNbrRestartHelperAge,
          ospfNbrRestartHelperExitReason
          }
      STATUS       current
      DESCRIPTION
          "These objects are used to monitor/manage OSPF
          neighbors."
      ::= { ospfGroups 21 }

  ospfVirtNbrGroup2    OBJECT-GROUP
      OBJECTS {
          ospfVirtNbrArea,
          ospfVirtNbrRtrId,
          ospfVirtNbrIpAddr,
          ospfVirtNbrOptions,
          ospfVirtNbrState,
          ospfVirtNbrEvents,
          ospfVirtNbrLsRetransQLen,
          ospfVirtNbrHelloSuppressed,
          ospfVirtNbrRestartHelperStatus,
          ospfVirtNbrRestartHelperAge,
          ospfVirtNbrRestartHelperExitReason
```

```
            }
        STATUS       current
        DESCRIPTION
            "These objects are used to monitor/manage OSPF
            virtual neighbors."
        ::= { ospfGroups 22 }

    ospfAreaAggregateGroup2    OBJECT-GROUP
        OBJECTS {
            ospfAreaAggregateAreaID,
            ospfAreaAggregateLsdbType,
            ospfAreaAggregateNet,
            ospfAreaAggregateMask,
            ospfAreaAggregateStatus,
            ospfAreaAggregateEffect,
            ospfAreaAggregateExtRouteTag
            }
        STATUS       current
        DESCRIPTION
            "These objects are used for OSPF systems to support
            network prefix aggregation across areas."
        ::= { ospfGroups 23 }

    ospfAreaLsaCountGroup      OBJECT-GROUP
        OBJECTS {
            ospfAreaLsaCountNumber
            }
        STATUS       current
        DESCRIPTION
            "These objects are used for OSPF systems that display
            per-area, per-LSA-type counters."
        ::= { ospfGroups 24 }

    ospfHostGroup2    OBJECT-GROUP
        OBJECTS {
            ospfHostIpAddress,
            ospfHostTOS,
            ospfHostMetric,
            ospfHostStatus,
            ospfHostCfgAreaID
            }
        STATUS       current
        DESCRIPTION
            "These objects are used for OSPF systems
            that support attached hosts."
        ::= { ospfGroups 25 }

--      This object group is included for SMI conformance.  It is not a
```

```
--     mandatory group for compliance with this MIB

  ospfObsoleteGroup    OBJECT-GROUP
       OBJECTS {
          ospfAuthType
          }
       STATUS       obsolete
       DESCRIPTION
          "These objects are obsolete and are no longer required for
          OSPF systems.  They are placed into this group for SMI
          conformance."
       ::= { ospfGroups 26 }

END
```

4. OSPF Trap Overview

4.1. Introduction

OSPF is an event-driven routing protocol, where an event can be a change in an OSPF interface's link-level status, the expiration of an OSPF timer, or the reception of an OSPF protocol packet. Many of the actions that OSPF takes as a result of these events will result in a change of the routing topology.

As routing topologies become large and complex, it is often difficult to locate the source of a topology change or unpredicted routing path by polling a large number or routers. Because of the difficulty of polling a large number of devices, a more prudent approach is for devices to notify a network manager of potentially critical OSPF events using SNMP traps.

This section defines a set of traps, objects, and mechanisms to enhance the ability to manage IP internetworks that use OSPF as their Interior Gateway Protocol (IGP). It is an optional but very useful extension to the OSPF MIB.

4.2. Approach

The mechanism for sending traps is straightforward. When an exception event occurs, the application notifies the local agent, who sends a trap to the appropriate SNMP management stations. The message includes the trap type and may include a list of trap-specific variables. Section 5 gives the trap definitions, which includes the variable lists. The Router ID of the originator of the trap is included in the variable list so that the network manager may easily determine the source of the trap.

To limit the frequency of OSPF traps, the following additional mechanisms are suggested.

4.3. Ignoring Initial Activity

The majority of critical events occur when OSPF is enabled on a router, at which time the designated router is elected and neighbor adjacencies are formed. During this initial period, a potential flood of traps is unnecessary since the events are expected. To avoid unnecessary traps, a router should not originate expected OSPF interface-related traps until two of that interface's dead timer intervals have elapsed. The expected OSPF interface traps are ospfIfStateChange, ospfVirtIfStateChange, ospfNbrStateChange, ospfVirtNbrStateChange, ospfTxRetransmit, and ospfVirtIfTxRetransmit. Additionally, ospfMaxAgeLsa and ospfOriginateLsa traps should not be originated until two dead timer intervals have elapsed where the dead timer interval used should be the dead timer with the smallest value.

4.4. Throttling Traps

The mechanism for throttling the traps is similar to the mechanism explained in RFC 1224 [RFC1224]. The basic premise of the throttling mechanism is that of a sliding window, defined in seconds and an upper bound on the number of traps that may be generated within this window. Note that unlike RFC 1224, traps are not sent to inform the network manager that the throttling mechanism has kicked in.

A single window should be used to throttle all OSPF trap types except for the ospfLsdbOverflow and the ospfLsdbApproachingOverflow traps, which should not be throttled. For example, with a window time of 3, an upper bound of 3, and events to cause trap types 1, 3, 5, and 7 (4 traps within a 3-second period), the type-7 (the 4th) trap should not be generated.

Appropriate values are 7 traps with a window time of 10 seconds.

4.5. One Trap Per OSPF Event

Several of the traps defined in section 5 are generated as the result of finding an unusual condition while parsing an OSPF packet or a processing a timer event. There may be more than one unusual condition detected while handling the event. For example, a link state update packet may contain several retransmitted link state advertisements (LSAs), or a retransmitted database description packet may contain several database description entries. To limit the number of traps and variables, OSPF should generate at most one trap per OSPF event. Only the variables associated with the first unusual condition should be included with the trap. Similarly, if more than one type of unusual condition is encountered while parsing the packet, only the first event will generate a trap.

4.6. Polling Event Counters

Many of the tables in the OSPF MIB contain generalized event counters. By enabling the traps defined in this document, a network manager can obtain more specific information about these events. A network manager may want to poll these event counters and enable specific OSPF traps when a particular counter starts increasing abnormally.

The following table shows the relationship between the event counters defined in the OSPF MIB and the trap types.

Counter32	Trap Type
ospfOriginateNewLsas	ospfOriginateLsa
ospfIfEvents	ospfIfStateChange
	ospfConfigError
	ospfIfAuthFailure
	ospfRxBadPacket
	ospfTxRetransmit
ospfVirtIfEvents	ospfVirtIfStateChange
	ospfVirtIfConfigError
	ospfVirtIfAuthFailure
	ospfVirtIfRxBadPacket
	ospfVirtIfTxRetransmit
ospfNbrEvents	ospfNbrStateChange
ospfVirtNbrEvents	ospfVirtNbrStateChange
ospfExternLSACount	ospfLsdbApproachingOverflow
ospfExternLSACount	ospfLsdbOverflow

4.7. Translating Notification Parameters

The definition of the OSPF notifications pre-dates the RFC 2578 [RFC2578] requirement of having a zero value for the penultimate sub-identifier for translating SNMPv2/SNMPv3 trap parameters to SNMPv1 trap parameters. RFC 3584 [RFC3584], section 3, defines the translation rules that can be implemented by intermediate proxy-agents or multi-lingual agents to convert SNMPv2/SNMPv3 notifications to SNMPv1 notifications and vice versa. The conversion is not reversible, that is, a conversion to one SNMP version and then back again will result in an incorrectly formatted version of the notification.

According to the rules specified in RFC 3584, section 3.1, translation of OSPF notifications from SNMPv1 to SNMPv2/SNMPv3 would result in the SNMPv2/SNMPv3 snmpTrapOID being the concatenation of the SNMPv1 'enterprise' parameter and two additional sub-identifiers, '0' and the SNMPv1 'specific-trap' parameter.

According to the rules specified in RFC 3584, section 3.2, translation of OSPF notifications from SNMPv2/SNMPv3 to SNMPv1, as the notifications are defined in this MIB, would result in the SNMPv1 'enterprise' parameter being set to the SNMPv2/SNMPv3 snmpTrapOID parameter value with the last sub-identifier removed and the 'specific-trap' parameter being set to the last sub-identifier of the SNMPv2/SNMPv3 snmpTrapOID parameter.

Note that a notification originated from an SNMPv1 agent will not be converted into the same notification that would be originated from a native SNMPv2/SNMPv3 agent.

4.8. Historical Artifacts

The MIB modules that are updated by this document were originally written in SMIv1 for SNMPv1 when only traps were used. Since this version of the MIB module is written in SMIv2, it should be understood that all types of notifications, trap and inform PDUs, may be used by native SNMPv2 and SNMPv3 agents, although only traps are mentioned. Also, for backwards compatibility, the OSPF Trap module remains rooted at {ospf 16}.

5. OSPF Trap Definitions

```
   OSPF-TRAP-MIB DEFINITIONS ::= BEGIN

   IMPORTS
       MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE, IpAddress
                   FROM SNMPv2-SMI
       MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
                   FROM SNMPv2-CONF
       ospfRouterId, ospfIfIpAddress, ospfAddressLessIf, ospfIfState,
       ospfVirtIfAreaId, ospfVirtIfNeighbor, ospfVirtIfState,
       ospfNbrIpAddr, ospfNbrAddressLessIndex, ospfNbrRtrId,
       ospfNbrState, ospfVirtNbrArea, ospfVirtNbrRtrId,
       ospfVirtNbrState, ospfLsdbType, ospfLsdbLsid, ospfLsdbRouterId,
       ospfLsdbAreaId, ospfExtLsdbLimit, ospf, ospfAreaId,
       ospfAreaNssaTranslatorState, ospfRestartStatus,
       ospfRestartInterval, ospfRestartExitReason,
       ospfNbrRestartHelperStatus, ospfNbrRestartHelperAge,
       ospfNbrRestartHelperExitReason, ospfVirtNbrRestartHelperStatus,
       ospfVirtNbrRestartHelperAge, ospfVirtNbrRestartHelperExitReason
                   FROM OSPF-MIB;

     ospfTrap MODULE-IDENTITY

          LAST-UPDATED "200611100000Z" -- November 10, 2006 00:00:00 EST
          ORGANIZATION "IETF OSPF Working Group"
          CONTACT-INFO
          "WG E-Mail: ospf@ietf.org

           WG Chairs: acee@cisco.com
                      rohit@gmail.com

           Editors:   Dan Joyal
                      Nortel
                      600 Technology Park Drive
                      Billerica, MA  01821
                      djoyal@nortel.com

                      Piotr Galecki
                      Airvana
                      19 Alpha Road
                      Chelmsford, MA 01824
                      pgalecki@airvana.com

                      Spencer Giacalone
                      CSFB
                      Eleven Madison Ave
                      New York, NY 10010-3629
```

```
                    spencer.giacalone@gmail.com"

          DESCRIPTION
             "The MIB module to describe traps for the OSPF
             Version 2 Protocol.

             Copyright (C) The IETF Trust (2006).
             This version of this MIB module is part of
             RFC 4750;  see the RFC itself for full legal
             notices."

          REVISION "200611100000Z" -- November 10, 2006 00:00:00 EST
          DESCRIPTION
             "Updated for latest changes to OSPFv2:
              -added graceful restart related traps
              -added new config error types
              -added ospfNssaTranslatorStatusChange trap.
              See Appendix B of RFC 4750 for more details.

             This version published as part of RFC 4750"

          REVISION "199501201225Z" -- Fri Jan 20 12:25:50 PST 1995
          DESCRIPTION
             "The initial SMIv2 revision of this MIB module, published
             in RFC 1850."

          ::= { ospf 16 }

   --  Trap Support Objects

   --  The following are support objects for the OSPF traps.

     ospfTrapControl OBJECT IDENTIFIER ::= { ospfTrap 1 }
     ospfTraps OBJECT IDENTIFIER ::= { ospfTrap 2 }

     ospfSetTrap OBJECT-TYPE
          SYNTAX       OCTET STRING (SIZE(4))
          MAX-ACCESS   read-write
          STATUS       current
          DESCRIPTION
             "A 4-octet string serving as a bit map for
             the trap events defined by the OSPF traps.  This
             object is used to enable and disable specific
             OSPF traps where a 1 in the bit field
             represents enabled.  The right-most bit (least
             significant) represents trap 0.

             This object is persistent and when written
```

```
            the entity SHOULD save the change to non-volatile
            storage."
          ::= { ospfTrapControl 1 }

     ospfConfigErrorType OBJECT-TYPE
          SYNTAX       INTEGER {
                          badVersion (1),
                          areaMismatch (2),
                          unknownNbmaNbr (3), -- Router is DR eligible
                          unknownVirtualNbr (4),
                          authTypeMismatch(5),
                          authFailure (6),
                          netMaskMismatch (7),
                          helloIntervalMismatch (8),
                          deadIntervalMismatch (9),
                          optionMismatch (10),
                          mtuMismatch (11),
                          duplicateRouterId (12),
                          noError (13) }
          MAX-ACCESS   read-only
          STATUS   current
          DESCRIPTION
             "Potential types of configuration conflicts.
             Used by the ospfConfigError and
             ospfConfigVirtError traps.  When the last value
             of a trap using this object is needed, but no
             traps of that type have been sent, this value
             pertaining to this object should be returned as
             noError."
          ::= { ospfTrapControl 2 }

     ospfPacketType OBJECT-TYPE
          SYNTAX       INTEGER {
                          hello (1),
                          dbDescript (2),
                          lsReq (3),
                          lsUpdate (4),
                          lsAck (5),
                          nullPacket (6) }
          MAX-ACCESS   read-only
          STATUS       current
          DESCRIPTION
             "OSPF packet types.  When the last value of a trap
             using this object is needed, but no traps of
             that type have been sent, this value pertaining
             to this object should be returned as nullPacket."
          ::= { ospfTrapControl 3 }
```

```
     ospfPacketSrc OBJECT-TYPE
          SYNTAX       IpAddress
          MAX-ACCESS   read-only
          STATUS       current
          DESCRIPTION
             "The IP address of an inbound packet that cannot
             be identified by a neighbor instance.  When
             the last value of a trap using this object is
             needed, but no traps of that type have been sent,
             this value pertaining to this object should
             be returned as 0.0.0.0."
          ::= { ospfTrapControl 4 }

   --  Traps

     ospfVirtIfStateChange NOTIFICATION-TYPE
          OBJECTS { ospfRouterId, -- The originator of the trap
             ospfVirtIfAreaId,
             ospfVirtIfNeighbor,
             ospfVirtIfState  -- The new state
             }
          STATUS       current
          DESCRIPTION
             "An ospfVirtIfStateChange trap signifies that there
             has been a change in the state of an OSPF virtual
             interface.

             This trap should be generated when the interface
             state regresses (e.g., goes from Point-to-Point to Down)
             or progresses to a terminal state
             (i.e., Point-to-Point)."
          ::= { ospfTraps 1 }

     ospfNbrStateChange NOTIFICATION-TYPE
          OBJECTS { ospfRouterId, -- The originator of the trap
             ospfNbrIpAddr,
             ospfNbrAddressLessIndex,
             ospfNbrRtrId,
             ospfNbrState  -- The new state
             }
          STATUS       current
          DESCRIPTION
             "An ospfNbrStateChange trap signifies that
             there has been a change in the state of a
             non-virtual OSPF neighbor.  This trap should be
             generated when the neighbor state regresses
             (e.g., goes from Attempt or Full to 1-Way or
             Down) or progresses to a terminal state (e.g.,
```

```
            2-Way or Full).  When an neighbor transitions
            from or to Full on non-broadcast multi-access
            and broadcast networks, the trap should be
            generated by the designated router.  A designated
            router transitioning to Down will be noted by
            ospfIfStateChange."
         ::= { ospfTraps 2 }

      ospfVirtNbrStateChange NOTIFICATION-TYPE
         OBJECTS { ospfRouterId, -- The originator of the trap
            ospfVirtNbrArea,
            ospfVirtNbrRtrId,
            ospfVirtNbrState  -- The new state
            }
         STATUS       current
         DESCRIPTION
            "An ospfVirtNbrStateChange trap signifies that there
            has been a change in the state of an OSPF virtual
            neighbor.  This trap should be generated
            when the neighbor state regresses (e.g., goes
            from Attempt or Full to 1-Way or Down) or
            progresses to a terminal state (e.g., Full)."
         ::= { ospfTraps 3 }

      ospfIfConfigError NOTIFICATION-TYPE
         OBJECTS { ospfRouterId, -- The originator of the trap
            ospfIfIpAddress,
            ospfAddressLessIf,
            ospfPacketSrc,  -- The source IP address
            ospfConfigErrorType, -- Type of error
            ospfPacketType
            }
         STATUS       current
         DESCRIPTION
            "An ospfIfConfigError trap signifies that a
            packet has been received on a non-virtual
            interface from a router whose configuration
            parameters conflict with this router's
            configuration parameters.  Note that the event
            optionMismatch should cause a trap only if it
            prevents an adjacency from forming."
         ::= { ospfTraps 4 }

      ospfVirtIfConfigError NOTIFICATION-TYPE
         OBJECTS { ospfRouterId, -- The originator of the trap
            ospfVirtIfAreaId,
            ospfVirtIfNeighbor,
            ospfConfigErrorType, -- Type of error
```

```
            ospfPacketType
            }
        STATUS       current
        DESCRIPTION
            "An ospfVirtIfConfigError trap signifies that a
            packet has been received on a virtual interface
            from a router whose configuration parameters
            conflict with this router's configuration
            parameters.  Note that the event optionMismatch
            should cause a trap only if it prevents an
            adjacency from forming."
        ::= { ospfTraps 5 }

    ospfIfAuthFailure NOTIFICATION-TYPE
        OBJECTS { ospfRouterId, -- The originator of the trap
            ospfIfIpAddress,
            ospfAddressLessIf,
            ospfPacketSrc,  -- The source IP address
            ospfConfigErrorType, -- authTypeMismatch or
                                 -- authFailure
            ospfPacketType
            }
        STATUS       current
        DESCRIPTION
            "An ospfIfAuthFailure trap signifies that a
            packet has been received on a non-virtual
            interface from a router whose authentication key
            or authentication type conflicts with this
            router's authentication key or authentication
            type."
        ::= { ospfTraps 6 }

    ospfVirtIfAuthFailure NOTIFICATION-TYPE
        OBJECTS { ospfRouterId, -- The originator of the trap
            ospfVirtIfAreaId,
            ospfVirtIfNeighbor,
            ospfConfigErrorType, -- authTypeMismatch or
                                 -- authFailure
            ospfPacketType
            }
        STATUS       current
        DESCRIPTION
            "An ospfVirtIfAuthFailure trap signifies that a
            packet has been received on a virtual interface
            from a router whose authentication key or
            authentication type conflicts with this router's
            authentication key or authentication type."
```

```
          ::= { ospfTraps 7 }

     ospfIfRxBadPacket NOTIFICATION-TYPE
          OBJECTS { ospfRouterId, -- The originator of the trap
             ospfIfIpAddress,
             ospfAddressLessIf,
             ospfPacketSrc,  -- The source IP address
             ospfPacketType
             }
          STATUS       current
          DESCRIPTION
             "An ospfIfRxBadPacket trap signifies that an
             OSPF packet has been received on a non-virtual
             interface that cannot be parsed."
          ::= { ospfTraps 8 }

     ospfVirtIfRxBadPacket NOTIFICATION-TYPE
          OBJECTS { ospfRouterId, -- The originator of the trap
            ospfVirtIfAreaId,
            ospfVirtIfNeighbor,
            ospfPacketType
            }
          STATUS       current
          DESCRIPTION
             "An ospfVirtIfRxBadPacket trap signifies that an OSPF
             packet has been received on a virtual interface
             that cannot be parsed."
          ::= { ospfTraps 9 }

     ospfTxRetransmit NOTIFICATION-TYPE
          OBJECTS { ospfRouterId, -- The originator of the trap
             ospfIfIpAddress,
             ospfAddressLessIf,
             ospfNbrRtrId, -- Destination
             ospfPacketType,
             ospfLsdbType,
             ospfLsdbLsid,
             ospfLsdbRouterId
             }
           STATUS       current
           DESCRIPTION
              "An ospfTxRetransmit trap signifies than an
              OSPF packet has been retransmitted on a
              non-virtual interface.  All packets that may be
              retransmitted are associated with an LSDB entry.
              The LS type, LS ID, and Router ID are used to
              identify the LSDB entry."
           ::= { ospfTraps 10 }
```

```
     ospfVirtIfTxRetransmit NOTIFICATION-TYPE
          OBJECTS { ospfRouterId, -- The originator of the trap
             ospfVirtIfAreaId,
             ospfVirtIfNeighbor,
             ospfPacketType,
             ospfLsdbType,
             ospfLsdbLsid,
             ospfLsdbRouterId
             }
          STATUS       current
          DESCRIPTION
             "An ospfVirtIfTxRetransmit trap signifies than an
             OSPF packet has been retransmitted on a virtual
             interface.  All packets that may be retransmitted
             are associated with an LSDB entry.  The LS
             type, LS ID, and Router ID are used to identify
             the LSDB entry."
          ::= { ospfTraps 11 }

     ospfOriginateLsa NOTIFICATION-TYPE
          OBJECTS { ospfRouterId, -- The originator of the trap
             ospfLsdbAreaId,  -- 0.0.0.0 for AS Externals
             ospfLsdbType,
             ospfLsdbLsid,
             ospfLsdbRouterId
             }
          STATUS       current
          DESCRIPTION
             "An ospfOriginateLsa trap signifies that a new
             LSA has been originated by this router.  This
             trap should not be invoked for simple refreshes
             of LSAs (which happens every 30 minutes), but
             instead will only be invoked when an LSA is
             (re)originated due to a topology change.
             Additionally, this trap does not include LSAs that
             are being flushed because they have reached
             MaxAge."
          ::= { ospfTraps 12 }

     ospfMaxAgeLsa NOTIFICATION-TYPE
          OBJECTS { ospfRouterId, -- The originator of the trap
             ospfLsdbAreaId,  -- 0.0.0.0 for AS Externals
             ospfLsdbType,
             ospfLsdbLsid,
             ospfLsdbRouterId
             }
          STATUS       current
          DESCRIPTION
```

```
            "An ospfMaxAgeLsa trap signifies that one of
            the LSAs in the router's link state database has
            aged to MaxAge."
         ::= { ospfTraps 13 }

      ospfLsdbOverflow NOTIFICATION-TYPE
           OBJECTS { ospfRouterId, -- The originator of the trap
              ospfExtLsdbLimit
              }

           STATUS       current
           DESCRIPTION
              "An ospfLsdbOverflow trap signifies that the
              number of LSAs in the router's link state
              database has exceeded ospfExtLsdbLimit."
           ::= { ospfTraps 14 }

      ospfLsdbApproachingOverflow NOTIFICATION-TYPE
           OBJECTS { ospfRouterId, -- The originator of the trap
              ospfExtLsdbLimit
              }
           STATUS       current
           DESCRIPTION
              "An ospfLsdbApproachingOverflow trap signifies
              that the number of LSAs in the router's
              link state database has exceeded ninety percent of
              ospfExtLsdbLimit."
           ::= { ospfTraps 15 }

      ospfIfStateChange NOTIFICATION-TYPE
           OBJECTS { ospfRouterId, -- The originator of the trap
              ospfIfIpAddress,
              ospfAddressLessIf,
              ospfIfState   -- The new state
              }
           STATUS       current
           DESCRIPTION
              "An ospfIfStateChange trap signifies that there
              has been a change in the state of a non-virtual
              OSPF interface.  This trap should be generated
              when the interface state regresses (e.g., goes
              from Dr to Down) or progresses to a terminal
              state (i.e., Point-to-Point, DR Other, Dr, or
              Backup)."
           ::= { ospfTraps 16 }

      ospfNssaTranslatorStatusChange NOTIFICATION-TYPE
           OBJECTS { ospfRouterId, -- The originator of the trap
```

```
            ospfAreaId,
            ospfAreaNssaTranslatorState -- The current translation
                                        -- status
            }
        STATUS       current
        DESCRIPTION
            "An ospfNssaTranslatorStatusChange trap indicates that
            there has been a change in the router's ability to
            translate OSPF type-7 LSAs into OSPF type-5 LSAs.
            This trap should be generated when the translator
            status transitions from or to any defined status on
            a per-area basis."
        ::= { ospfTraps 17 }

    ospfRestartStatusChange NOTIFICATION-TYPE
        OBJECTS { ospfRouterId, -- The originator of the trap
                  ospfRestartStatus,
                  ospfRestartInterval,
                  ospfRestartExitReason
                }
        STATUS       current
        DESCRIPTION
            "An ospfRestartStatusChange trap signifies that
            there has been a change in the graceful restart
            state for the router.  This trap should be
            generated when the router restart status
            changes."
        ::= { ospfTraps 18 }

    ospfNbrRestartHelperStatusChange NOTIFICATION-TYPE
        OBJECTS { ospfRouterId, -- The originator of the trap
                  ospfNbrIpAddr,
                  ospfNbrAddressLessIndex,
                  ospfNbrRtrId,
                  ospfNbrRestartHelperStatus,
                  ospfNbrRestartHelperAge,
                  ospfNbrRestartHelperExitReason
                }
        STATUS       current
        DESCRIPTION
            "An ospfNbrRestartHelperStatusChange trap signifies that
            there has been a change in the graceful restart
            helper state for the neighbor.  This trap should be
            generated when the neighbor restart helper status
            transitions for a neighbor."
        ::= { ospfTraps 19 }

    ospfVirtNbrRestartHelperStatusChange NOTIFICATION-TYPE
```

```
          OBJECTS { ospfRouterId, -- The originator of the trap
                    ospfVirtNbrArea,
                    ospfVirtNbrRtrId,
                    ospfVirtNbrRestartHelperStatus,
                    ospfVirtNbrRestartHelperAge,
                    ospfVirtNbrRestartHelperExitReason
                  }
          STATUS       current
          DESCRIPTION
             "An ospfVirtNbrRestartHelperStatusChange trap signifies
             that there has been a change in the graceful restart
             helper state for the virtual neighbor.  This trap should
             be generated when the virtual neighbor restart helper
             status transitions for a virtual neighbor."
          ::= { ospfTraps 20 }

   --  conformance information

   ospfTrapConformance OBJECT IDENTIFIER ::= { ospfTrap 3 }
   ospfTrapGroups      OBJECT IDENTIFIER ::= { ospfTrapConformance 1 }
   ospfTrapCompliances OBJECT IDENTIFIER ::= { ospfTrapConformance 2 }

   --  compliance statements

   ospfTrapCompliance MODULE-COMPLIANCE
        STATUS       obsolete
        DESCRIPTION
           "The compliance statement."
        MODULE       -- this module
        MANDATORY-GROUPS { ospfTrapControlGroup }

        GROUP       ospfTrapControlGroup
        DESCRIPTION
           "This group is optional but recommended for all
           OSPF systems."
        ::= { ospfTrapCompliances 1 }

   ospfTrapCompliance2 MODULE-COMPLIANCE
        STATUS       current
        DESCRIPTION
           "The compliance statement."
        MODULE       -- this module
        MANDATORY-GROUPS { ospfTrapControlGroup, ospfTrapEventGroup }
        OBJECT       ospfConfigErrorType
        MIN-ACCESS   accessible-for-notify
        DESCRIPTION
           "This object is only required to be supplied within
           notifications."
```

```
        OBJECT       ospfPacketType
        MIN-ACCESS   accessible-for-notify
        DESCRIPTION
           "This object is only required to be supplied within
           notifications."
        OBJECT       ospfPacketSrc
        MIN-ACCESS   accessible-for-notify
        DESCRIPTION
           "This object is only required to be supplied within
           notifications."
        ::= { ospfTrapCompliances 2 }

   --  units of conformance

     ospfTrapControlGroup    OBJECT-GROUP
          OBJECTS { ospfSetTrap,
                    ospfConfigErrorType,
                    ospfPacketType,
                    ospfPacketSrc }
          STATUS       current
          DESCRIPTION
             "These objects are required to control traps
             from OSPF systems."
          ::= { ospfTrapGroups 1 }

     ospfTrapEventGroup       NOTIFICATION-GROUP
          NOTIFICATIONS {
             ospfVirtIfStateChange,
             ospfNbrStateChange,
             ospfVirtNbrStateChange,
             ospfIfConfigError,
             ospfVirtIfConfigError,
             ospfIfAuthFailure,
             ospfVirtIfAuthFailure,
             ospfIfRxBadPacket,
             ospfVirtIfRxBadPacket,
             ospfTxRetransmit,
             ospfVirtIfTxRetransmit,
             ospfOriginateLsa,
             ospfMaxAgeLsa,
             ospfLsdbOverflow,
             ospfLsdbApproachingOverflow,
             ospfIfStateChange,
             ospfNssaTranslatorStatusChange,
             ospfRestartStatusChange,
             ospfNbrRestartHelperStatusChange,
             ospfVirtNbrRestartHelperStatusChange
             }
```

```
        STATUS       current
        DESCRIPTION
           "A grouping of OSPF trap events, as specified
           in NOTIFICATION-TYPE constructs."
        ::= { ospfTrapGroups 2 }

   END
```

6. Security Considerations

There are a number of management objects defined in this MIB that have a MAX-ACCESS clause of read-write and/or read-create. Such objects may be considered sensitive or vulnerable in some network environments. The support for SET operations in a non-secure environment without proper protection can have a negative effect on network operations.

It is recommended that attention be specifically given to implementing the MAX-ACCESS clause in a number of objects, including ospfIfAuthKey, ospfIfAuthType, ospfVirtIfAuthKey, and ospfVirtIfAuthType in scenarios that DO NOT use SNMPv3 strong security (i.e., authentication and encryption). Extreme caution must be used to minimize the risk of cascading security vulnerabilities when SNMPv3 strong security is not used. When SNMPv3 strong security is not used, these objects should have access of read-only, not read-create.

SNMPv1 by itself is not a secure environment. Even if the network itself is secure (for example by using IPsec), even then, there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB.

It is recommended that the implementers consider the security features as provided by the SNMPv3 framework. Specifically, the use of the User-based Security Model RFC 3414 [RFC3414] and the View-based Access Control Model RFC 3415 [RFC3415] is recommended.

It is then a customer/user responsibility to ensure that the SNMP entity giving access to an instance of this MIB, is properly configured to give access to the objects only to those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

7. IANA Considerations

The MIB module in this document uses the following IANA-assigned OBJECT IDENTIFIER values recorded in the SMI Numbers registry:

Descriptor	OBJECT IDENTIFIER value
ospf	{ mib-2 14 }

8. Acknowledgements

This document was produced by the OSPF Working Group and is based on the MIB for OSPF version 2 by Rob Coltun and Fred Baker [RFC1850]. The editors would like to acknowledge John Moy, Rob Coltun, Randall Atkinson, David T. Perkins, Ken Chapman, Brian Field, Acee Lindem, Vishwas Manral, Roy Jose, Don Goodspeed, Vivek Dubey, Keith McCloghrie, Bill Fenner, and Dan Romascanu for their constructive comments.

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Appendix A. TOS Support

For backward compatibility with previous versions of the OSPF MIB specification, TOS-specific information has been retained in this document, though the TOS routing option has been deleted from OSPF [RFC2328].

Appendix B. Changes from RFC 1850

This section documents the differences between this memo and RFC 1850.

Appendix B.1. General Group Changes

Added object ospfRFC1583Compatibility to indicate support with "RFC 1583 Compatibility" [RFC1583]. This object has DEFVAL of "enabled".

Added object ospfReferenceBandwidth to allow configuration of a reference bandwidth for calculation of default interface metrics.

Added objects ospfRestartSupport, ospfRestartInterval, ospfRestartAge, ospfRestartStrictLsaChecking, and ospfRestartExitReason to support graceful restart.

Added objects ospfStubRouterSupport and ospfStubRouteAdvertisement to support stub routers.

Added object ospfDiscontinuityTime in order for a management entity to detect counter discontinuity events.

Appendix B.2. OSPF NSSA Enhancement Support

Added new objects to OspfAreaTable including the following:

-ospfAreaNssaTranslatorRole to indicate the configured NSSA translation role.

-ospfAreaNssaTranslatorState to indicate the current NSSA translation role.

-ospfAreaNssaTranslatorStabilityInterval to indicate time to continue to perform at current translation status.

-ospfAreaNssaTranslatorEvents to indicate the number of times OSPF translation state has changed.

Added new object ospfAreaAggregateExtRouteTag to ospfAreaAggregateTable.

Added new object ospfNssaTranslatorStatusChange to ospfTraps in OSPF-TRAP-MIB DEFINITIONS.

Added ospfAreaId to IMPORTS in OSPF-TRAP-MIB DEFINITIONS to support ospfNssaTranslatorStatusChange.

Added ospfAreaExtNssaTranslatorStatus to IMPORTS in OSPF-TRAP-MIB DEFINITIONS to support ospfNssaTranslatorStatusChange.

Modified the DESCRIPTION clause of the ospfAreaSummary object in the ospfAreaTable to indicate support for NSSA.

Modified the DESCRIPTION clause of the ospfImportAsExtern object in the ospfAreaTable for clarity.

Appendix B.3. Opaque LSA Support

Added object ospfOpaqueLsaSupport to ospfGeneralGroup to indicate support of OSPF Opaque LSAs.

Created ospfLocalLsdbTable, for link-local (type-9) LSA support. This table is indexed by the following:

-ospflocalLsdbIpAddress

-ospfLocalLsdbAddressLessIf

-ospfLocalLsdbType

-ospfLocalLsdbLsid

-ospfLocalLsdbRouterId

ospfLocalLsdbTable contains the following (columnar) objects:

-ospfLocalLsdbSequence, to indicate LSA instance

-ospfLocalLsdbAge

-ospfLocalLsdbChecksum

-ospfLocalLsdbAdvertisement, containing the entire LSA

Created ospfVirLocalLsdbTable, for link-local (type-9) LSA support on virtual links. This table is indexed by the following:

-ospfVirtLocalLsdbTransitArea

-ospfVirtLocalLsdbNeighbor, to indicate the router ID of the virtual neighbor

-ospfVirLocalLsdbType

-ospfVirLocalLsdbLsid

-ospfVirLocalLsdbRouterId

ospfVirLocalLsdbTable contains the following (columnar) objects:

-ospfVirLocalLsdbSequence, to indicate LSA instance

-ospfVirLocalLsdbAge

-ospfVirLocalLsdbChecksum

-ospfVirLocalLsdbAdvertisement, containing the entire LSA

Added objects to ospfIfTable to support link-local (type-9) LSAs, including the following:

-ospfIfLsaCount

-ospfIfLsaCksumSum, to indicate the sum of the type-9 link state advertisement checksums on this interface

Added objects to ospfVirIfTable, to support link-local (type-9) LSAs on virtual links, including the following:

-ospfVirIfLsaCount

-ospfVirIfLsaCksumSum, to indicate the sum of the type-9 link state advertisement checksums on this link

To support area scope (type-10) LSAs, the enumeration areaOpaqueLink (10) was added to ospfLsdbType in the ospfLsdbTable.

Created ospfAsLsdbTable, for AS-scope LSA support. This table is indexed by the following:

-ospfAsLsdbType

-ospfAsLsdbLsid

-ospfAsLsdbRouterId

ospfAsLsdbTable contains the following (columnar) objects:

-ospfAsLsdbSequence, to indicate LSA instance

-ospfAsLsdbAge

-ospfAsLsdbChecksum

-ospfAsLsdbAdvertisement, containing the entire LSA

Appendix B.4. Graceful Restart Support

Added objects ospfRestartSupport, ospfRestartInterval, ospfRestartAge, ospfRestartStrictLsaChecking, and ospfRestartExitReason to general group.

Added objects ospfNbrRestartHelperStatus, ospfNbrRestartHelperAge, and ospfNbrRestartHelperExitReason to OspfNbrTable.

Added objects ospfVirtNbrRestartHelperStatus, ospfVirtNbrRestartHelperAge, and ospfVirtNbrRestartHelperExitReason to OspfVirtNbrTable.

Appendix B.5. OSPF Compliances

New compliance statements were added for new and for obsoleted conformance groups. These statements include the following:

-ospfCompliance2

-ospfComplianceObsolete

New conformance groups were created to support new objects added to the group. These groups include the following:

-ospfBasicGroup2

-ospfAreaGroup2

-ospfIfGroup2

-ospfVirtIfGroup2

-ospfNbrGroup2

-ospfVirtNbrGroup2

-ospfAreaAggregateGroup2

Added completely new conformance groups, including the following:

-ospfLocalLsdbGroup, which specifies support for link-local (type-9) LSAs

-ospfVirtLocalLsdbGroup, which specifies support for link-local (type-9) LSAs on virtual links

-ospfObsoleteGroup, for obsolete objects and SMI compatibility

Appendix B.6. OSPF Authentication and Security

As there has been significant concern in the community regarding cascading security vulnerabilities, the following changes have been incorporated:

-Modified the DESCRIPTION clause of ospfIfAuthKey due to security concerns and to increase clarity

-Modified the DESCRIPTION clause of ospfVirtIfAuthKey due to security concerns and to increase clarity

-Modified the DESCRIPTION clause of ospfIfAuthType due to security concerns and to increase clarity

-Modified the DESCRIPTION clause of ospfVirtIfType due to security concerns and to increase clarity

-Modified the OSPF MIB MODULE DESCRIPTION due to security concerns and to include a reference to the Security Considerations section in this document that will transcend compilation

-Modified the Security Considerations section to provide detail

Appendix B.7. OSPF Trap MIB

Added ospfTrapEventGroup.

Added importation of NOTIFICATION-GROUP.

Changed the STATUS of the ospfTrapCompliance MODULE-COMPLIANCE construct to obsolete.

Added ospfTrapCompliance2 MODULE-COMPLIANCE construct, which replaces ospfTrapCompliance. OspfTrapCompliance includes an updated MANDATORY-GROUPS clause and new MIN-ACCESS specifications.

Added mtuMismatch enumeration to ospfConfigErrorType object in ospfTrapControl to imply MTU mismatch trap generation. in ospfIfConfigError.

Added noError enumeration to ospfConfigErrorType object for situations when traps are requested but none have been sent. Updated the DESCRIPTION clause accordingly.

Added nullPacket enumeration to ospfPacketType object for situations when traps are requested but none have been sent. Updated the DESCRIPTION clause accordingly.

Updated the DESCRIPTION clause of ospfPacketSrc for situations when traps are requested, but none have been sent.

Added NOTIFICATION-TYPE for ospfRestartStatusChange.

Added NOTIFICATION-TYPE for ospfNbrRestartHelperStatusChange.

Added NOTIFICATION-TYPE for ospfVirtNbrRestartHelperStatusChange.

Appendix B.8. Miscellaneous

Various sections have been moved or modified for clarity. Most of these changes are semantic in nature and include, but are not limited to the following:

-The OSPF overview section's format was revised. Unneeded information was removed. Removed information includes OSPF TOS default values.

-The trap overview section's format and working were revised. Unneeded information was removed.

-Modified the DESCRIPTION clause of "Status" "TEXTUAL-CONVENTION" for clarity.

-The Updates section was moved from the overview to its own section.

-Updated "REFERENCE" clauses in all objects, as needed.

-Modified the SEQUENCE of the OspfIfTable to reflect the true order of the objects in the table.

-Modified the DESCRIPTION clause of all row management objects for clarity.

Added ospfHostCfgAreaID to object to Host table with read-create access. Deprecated ospfHostAreaID.

Added importation of InterfaceIndexOrZero from IF-MIB. This TEXTUAL-CONVENTION will replace the InterfaceIndex TEXTUAL-CONVENTION.

Changed the SYNTAX clause of ospfNbrAddressLessIndex to use the semantically identical InterfaceIndexOrZero TEXTUAL-CONVENTION, as permitted by the SMI.

Changed the STATUS clause of the TEXTUAL-CONVENTION InterfaceIndex to obsolete and modified the DESCRIPTION accordingly.

Changed the SYNTAX clause of ospfAddressLessIf to use the semantically identical InterfaceIndexOrZero TEXTUAL-CONVENTION, as permitted by the SMI.

Changed the SYNTAX clause of ospfIfMetricAddressLessIf to use the semantically identical InterfaceIndexOrZero TEXTUAL-CONVENTION, as permitted by the SMI.

Changed importation of mib-2 from RFC1213-MIB to SNMPv2-SMI

Added Intellectual Property Rights section.

Updated REVISION DESCRIPTION clauses with description of major MIB modifications.

Moved all relevant MIB comments to objects' DESCRIPTION clauses.

Added reasoning for object deprecation.

Added persistence information for read-write, read-create objects.

Described conditions when columns can be modified in RowStatus managed rows as required by RFC 2579.

Defined OspfAuthenticationType TC and modified authentication type objects to use the new type.

Made index objects of new tables not accessible.

Added the UNITS clause to several objects.

Added ospfIfDesignatedRouterId and ospfIfBackupDesignatedRouterId to the OspfIfEntry.

Added the area LSA counter table.

Added IANA Considerations section.

Authors' Addresses

Dan Joyal (Editor)
Nortel, Inc.
600 Technology Park Drive
Billerica, MA 01821
USA

EMail: djoyal@nortel.com

Piotr Galecki (Editor)
Airvana, Inc.
19 Alpha Road
Chelmsford, MA 01824
USA

EMail: pgalecki@airvana.com

Spencer Giacalone (Editor)
CSFB
Eleven Madison Ave
New York, NY 10010-3629
USA

EMail: spencer.giacalone@gmail.com

Fred Baker
Cisco Systems
1121 Via Del Rey
Santa Barbara, California 93117
USA

EMail: fred@cisco.com

Rob Coltun
Touch Acoustra
3204 Brooklawn Terrace
Chevy Chase, MD 20815
USA

EMail: undisclosed

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Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.