

Network Working Group
Request For Comments: 1850
Obsoletes: 1253
Category: Standards Track

F. Baker
Cisco Systems
R. Coltun
RainbowBridge Communications
November 1995

OSPF Version 2 Management Information Base

Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

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 the Open Shortest Path First Routing Protocol.

Table of Contents

1. The SNMPv2 Network Management Framework	2
1.1 Object Definitions	3
2. Overview	3
2.1 Changes from RFC 1253	3
2.2 Textual Conventions	6
2.3 Structure of MIB	6
2.3.1 General Variables	6
2.3.2 Area Data Structure and Area Stub Metric Table	7
2.3.3 Link State Database and External Link State Database	7
2.3.4 Address Table and Host Tables	7
2.3.5 Interface and Interface Metric Tables	7
2.3.6 Virtual Interface Table	7
2.3.7 Neighbor and Virtual Neighbor Tables	7
2.4 Conceptual Row Creation	7
2.5 Default Configuration	8
3. Definitions	10
3.1 OSPF General Variables	13
3.2 OSPF Area Table	17

3.3 OSPF Area Default Metrics	21
3.4 OSPF Link State Database	25
3.5 OSPF Address Range Table	27
3.6 OSPF Host Table	29
3.7 OSPF Interface Table	32
3.8 OSPF Interface Metrics	39
3.9 OSPF Virtual Interface Table	42
3.10 OSPF Neighbor Table	46
3.11 OSPF Virtual Neighbor Table	51
3.12 OSPF External Link State Database	54
3.13 OSPF Route Table Use	57
3.14 OSPF Area Aggregate Table	58
4. OSPF Traps	66
4.1 Format Of Trap Definitions	67
4.2 Approach	67
4.3 Ignoring Initial Activity	67
4.4 Throttling Traps	67
4.5 One Trap Per OSPF Event	68
4.6 Polling Event Counters	68
5. OSPF Trap Definitions	69
5.1 Trap Support Objects	69
5.2 Traps	71
6. Acknowledgements	78
7. References	78
8. Security Considerations	80
9. Authors' Addresses	80

1. The SNMPv2 Network Management Framework

The SNMPv2 Network Management Framework consists of four major components. They are:

- o RFC 1441 which defines the SMI, the mechanisms used for describing and naming objects for the purpose of management.
- o STD 17, RFC 1213 defines MIB-II, the core set of managed objects for the Internet suite of protocols.
- o RFC 1445 which defines the administrative and other architectural aspects of the framework.
- o RFC 1448 which defines the protocol used for network access to managed objects.

The Framework permits new objects to be defined for the purpose of experimentation and evaluation.

1.1. Object Definitions

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the subset of Abstract Syntax Notation One (ASN.1) defined in the SMI. In particular, each object type is named by an OBJECT IDENTIFIER, an administratively assigned name. The object type together with an object instance serves to uniquely identify a specific instantiation of the object. For human convenience, we often use a textual string, termed the descriptor, to refer to the object type.

2. Overview

2.1. Changes from RFC 1253

The changes from RFC 1253 are the following:

- (1) The textual convention PositiveInteger was changed from 1..'FFFFFFFF'h to 1..'7FFFFFFFF'h at the request of Marshall Rose.
- (2) The textual convention TOSType was changed to reflect the TOS values defined in the Router Requirements Draft, and in accordance with the IP Forwarding Table MIB's values.
- (3) The names of some objects were changed, conforming to the convention that an acronym (for example, LSA) is a single word ("Lsa") in most SNMP names.
- (4) textual changes were made to make the MIB readable by Dave Perkins' SMIC MIB Compiler in addition to Mosy. This involved changing the case of some characters in certain names and removing the DEFVAL clauses for Counters.
- (5) The variables ospfAreaStatus and ospfIfStatus were added, having been overlooked in the original MIB.
- (6) The range of the variable ospfLsdbType was extended to include multicastLink (Group-membership LSA) and nssaExternalLink (NSSA LSA).
- (7) The variable ospfIfMetricMetric was renamed ospfIfMetricValue, and the following text was removed from its description:

"The value FFFF is distinguished to mean 'no route via

this TOS'."

- (8) The variable `ospfNbmaNbrPermanence` was added, with the values 'dynamic' and 'permanent'; by this means, dynamically learned and configured neighbors can be distinguished.

- (9) The DESCRIPTION of the variable `ospfNbrIpAddress` was changed from

"The IP address of this neighbor."

to

"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."

This is by way of clarification and does not change the specification.

- (10) The OSPF External Link State Database was added. The OSPF Link State Database used to display all LSAs stored; in this MIB, it displays all but the AS External LSAs. This is because there are usually a large number of External LSAs, and they are relocated in all non-Stub Areas.
- (11) The variable `ospfAreaSummary` was added to control the import of summary LSAs into stub areas. If it is `noAreaSummary` (default) the router will neither originate nor propagate summary LSAs into the stub area. It will rely entirely on its default route. If it is `sendAreaSummary`, the router will both summarize and propagate summary LSAs.
- (12) The general variables `ospfExtLsdbLimit` and `ExitOverflowInterval` were introduced to help handle LSDB overflow.
- (13) The use of the IP Forwarding Table is defined.
- (14) The `ospfAreaRangeTable` was obsoleted and replaced with the `ospfAreaAggregateTable` to accommodate two additional indexes. The `ospfAreaAggregateEntry` keys now include a `LsdbType` (which can be used to differentiate between the traditional type-3 Aggregates and NSSA Aggregates) and an

ospfAreaAggregateMask (which will more clearly express the range).

- (15) The variable ospfAreaAggregateEffect was added. This permits the network manager to hide a subnet within an area.
- (16) Normally, the border router of a stub area advertises a default route as an OSPF network summary. An NSSA border router will generate a type-7 LSA indicating a default route, and import it into the NSSA. ospfStubMetricType (ospf internal, type 1 external, or type 2 external) indicates the type of the default metric advertised.
- (17) ospfMulticastExtensions is added to the OSPF General Group. This indicates the router's ability to forward IP multicast (Class D) datagrams.
- (18) ospfIfMulticastForwarding is added to the Interface Group. It indicates whether, and if so, how, multicasts should be forwarded on the interface.
- (19) The MIB is converted to SNMP Version 2. Beyond simple text changes and the addition of the MODULE-IDENTITY and MODULE-COMPLIANCE macros, this involved trading the TruthValue Textual Convention for SNMP Version 2's, which has the same values, and trading the Validation Textual Convention for SNMP Version 2's RowStatus.
- (20) ospfAuthType (area authentication type) was changed to an interface authentication type to match the key. It also has an additional value, to indicate the use of MD5 for authentication.
- (21) ospfIfIntfType has a new value, pointToMultipoint.
- (22) ospfIfDemand (read/write) is added, to permit control of Demand OSPF features.
- (23) ospfNbrHelloSuppressed and ospfVirtNbrHelloSuppressed were added, (read only). They indicate whether Hellos are being suppressed to the neighbor.
- (24) ospfDemandExtensions was added to indicate whether the Demand OSPF extensions have been implemented, and to disable them if appropriate.

2.2. Textual Conventions

Several new data types are introduced as a textual convention in this MIB document. These textual conventions enhance the readability of the specification and can ease comparison with other specifications if appropriate. It should be noted that the introduction of the these textual conventions has no effect on either the syntax nor the semantics of any managed objects. The use of these is merely an artifact of the explanatory method used. Objects defined in terms of one of these methods are always encoded by means of the rules that define the primitive type. Hence, no changes to the SMI or the SNMP are necessary to accommodate these textual conventions which are adopted merely for the convenience of readers and writers in pursuit of the elusive goal of clear, concise, and unambiguous MIB documents.

The new data types are AreaID, RouterID, TOSType, Metric, BigMetric, Status, PositiveInteger, HelloRange, UpToMaxAge, InterfaceIndex, and DesignatedRouterPriority.

2.3. Structure of MIB

The MIB is composed of the following sections:

- General Variables
- Area Data Structure
- Area Stub Metric Table
- Link State Database
- 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

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

2.3.1. General Variables

The General Variables are about what they sound like; variables which are global to the OSPF Process.

2.3.2. Area Data Structure and Area Stub Metric Table

The Area Data Structure describes the OSPF Areas that the router participates in. The Area Stub Metric Table describes the metrics advertised into a stub area by the default router(s).

2.3.3. Link State Database and External Link State Database

The Link State Database is provided primarily to provide detailed information for network debugging.

2.3.4. Address Table and Host Tables

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

2.3.5. 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, and to provide flexibility in the event that the IP TOS definition is changed in the future. A Default Value specification is supplied for the TOS 0 (default) metric.

2.3.6. Virtual Interface Table

Likewise, the Virtual Interface Table describe virtual links to the OSPF Process.

2.3.7. Neighbor and Virtual Neighbor Tables

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

2.4. Conceptual Row Creation

For the benefit of row-creation in "conceptual" (see [9]) tables, DEFVAL (Default Value) clauses are included in the definitions in section 3, suggesting values which an agent should use for instances of variables which need to be created due to a Set-Request, but which are not specified in the Set-Request. DEFVAL clauses have not been specified for some objects which 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 RFC-791):

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

That is, 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 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.).

There are numerous read-write objects in this MIB, as it is designed for SNMP management of the protocol, not just SNMP monitoring of its state. However, in the absence of a standard SNMP Security architecture, it is acceptable for implementations to implement these as read-only with an alternative interface for their modification.

2.5. 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. 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 TOS 0 metrics are autonomously derived from ifSpeed
- The OSPF Process automatically creates the Areas required for the Interfaces

The simplest configuration of an OSPF process requires that:

- 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. 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.

3. Definitions

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

```
IMPORTS
```

```
    MODULE-IDENTITY, OBJECT-TYPE, Counter32, Gauge32,
    Integer32, IPAddress
        FROM SNMPv2-SMI
    TEXTUAL-CONVENTION, TruthValue, RowStatus
        FROM SNMPv2-TC
    MODULE-COMPLIANCE, OBJECT-GROUP                FROM SNMPv2-CONF
    mib-2                                           FROM RFC1213-MIB;
```

```
-- This MIB module uses the extended OBJECT-TYPE macro as
-- defined in [9].
```

```
ospf MODULE-IDENTITY
```

```
    LAST-UPDATED "9501201225Z" -- Fri Jan 20 12:25:50 PST 1995
```

```
    ORGANIZATION "IETF OSPF Working Group"
```

```
    CONTACT-INFO
```

```
    "      Fred Baker
Postal: Cisco Systems
        519 Lado Drive
        Santa Barbara, California 93111
Tel:    +1 805 681 0115
E-Mail: fred@cisco.com
```

```
        Rob Coltun
Postal: RainbowBridge Communications
Tel:    (301) 340-9416
E-Mail: rcoltun@rainbow-bridge.com"
```

```
DESCRIPTION
```

```
    "The MIB module to describe the OSPF Version 2
    Protocol"
```

```
 ::= { mib-2 14 }
```

```
-- 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
```

```
AreaID ::= TEXTUAL-CONVENTION
```

```
    STATUS      current
```

```
DESCRIPTION
```

```
    "An OSPF Area Identifier."
```

```
SYNTAX      IPAddress
```

```
-- The Router ID, in OSPF, has the same format as an IP Address,
```

-- but identifies the router independent of its IP Address.

```
RouterID ::= TEXTUAL-CONVENTION
    STATUS      current
    DESCRIPTION
        "A OSPF Router Identifier."
    SYNTAX      IpAddress
```

-- The OSPF Metric is defined as an unsigned value in the range

```
Metric ::= TEXTUAL-CONVENTION
    STATUS      current
    DESCRIPTION
        "The OSPF Internal Metric."
    SYNTAX      Integer32 (0..'FFFF'h)
```

```
BigMetric ::= TEXTUAL-CONVENTION
    STATUS      current
    DESCRIPTION
        "The OSPF External Metric."
    SYNTAX      Integer32 (0..'FFFFFF'h)
```

-- Status Values

```
Status ::= TEXTUAL-CONVENTION
    STATUS      current
    DESCRIPTION
        "The status of an interface: 'enabled' indicates that
        it is willing to communicate with other OSPF Routers,
        while 'disabled' indicates that it is not."
    SYNTAX      INTEGER { enabled (1), disabled (2) }
```

-- Time Durations measured in seconds

```
PositiveInteger ::= TEXTUAL-CONVENTION
    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
    STATUS      current
    DESCRIPTION
        "The range of intervals on which hello messages are
        exchanged."
    SYNTAX      Integer32 (1..'FFFF'h)
```

UpToMaxAge ::= TEXTUAL-CONVENTION

STATUS current

DESCRIPTION

"The values that one might find or configure for variables bounded by the maximum age of an LSA."

SYNTAX Integer32 (0..3600)

-- The range of ifIndex

InterfaceIndex ::= TEXTUAL-CONVENTION

STATUS current

DESCRIPTION

"The range of ifIndex."

SYNTAX Integer32

-- Potential Priorities for the Designated Router Election

DesignatedRouterPriority ::= TEXTUAL-CONVENTION

STATUS current

DESCRIPTION

"The values defined for the priority of a system for becoming the designated router."

SYNTAX Integer32 (0..'FF'h)

TOSType ::= TEXTUAL-CONVENTION

STATUS current

DESCRIPTION

"Type of Service 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)

-- OSPF General Variables

-- 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."

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."

::= { ospfGeneralGroup 2 }

ospfVersionNumber OBJECT-TYPE

SYNTAX INTEGER { version2 (2) }

MAX-ACCESS read-only

STATUS current

DESCRIPTION

```
        "The current version number of the OSPF proto-
        col 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 config-
        ured as an Autonomous System border router."
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 unsigned sum of the LS checksums of
    the external link-state advertisements con-
    tained 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."
::= { ospfGeneralGroup 7 }
```

```
ospfTOSSupport OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
        "The router's support for type-of-service rout-
        ing."
    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 in-
        cremented each time the router originates a new
        LSA."
    ::= { ospfGeneralGroup 9 }
```

```
ospfRxNewLsas OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The number of link-state advertisements re-
        ceived determined to be new instantiations.
        This number does not include newer instantia-
        tions of self-originated link-state advertise-
        ments."
    ::= { 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)."

`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."

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 OverflowState until restarted."

DEFVAL { 0 }
 ::= { ospfGeneralGroup 13 }

ospfDemandExtensions OBJECT-TYPE

SYNTAX TruthValue
 MAX-ACCESS read-write
 STATUS current
 DESCRIPTION

"The router's support for demand routing."

REFERENCE

"OSPF Version 2, Appendix on Demand Routing"

::= { ospfGeneralGroup 14 }

-- The OSPF Area Data Structure contains information
 -- regarding the various areas. The interfaces and
 -- virtual links are configured as part of these areas.
 -- Area 0.0.0.0, by definition, is the Backbone Area

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."

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."

INDEX { ospfAreaId }

::= { ospfAreaTable 1 }

OspfAreaEntry ::=

SEQUENCE {

ospfAreaId

AreaID,

ospfAuthType

Integer32,

ospfImportAsExtern

INTEGER,

ospfSpfRuns

Counter32,

ospfAreaBdrRtrCount

Gauge32,

ospfAsBdrRtrCount

Gauge32,

ospfAreaLsaCount

Gauge32,

ospfAreaLsaCksumSum

Integer32,

ospfAreaSummary

INTEGER,

ospfAreaStatus

RowStatus

}

ospfAreaId OBJECT-TYPE

SYNTAX AreaID

MAX-ACCESS read-only

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 Integer32
 -- none (0),
 -- simplePassword (1)
 -- md5 (2)
 -- reserved for specification by IANA (> 2)

MAX-ACCESS read-create

STATUS obsolete

DESCRIPTION

"The authentication type specified for an area.
 Additional authentication types may be assigned
 locally on a per Area basis."

REFERENCE

"OSPF Version 2, Appendix E Authentication"
 DEFVAL { 0 } -- no authentication, by default
 ::= { ospfAreaEntry 2 }

ospfImportAsExtern OBJECT-TYPE

SYNTAX INTEGER {
 importExternal (1),
 importNoExternal (2),
 importNssa (3)
 }

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The area's support for importing AS external
 link- state advertisements."

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."

```
::= { 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 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 LSA's."

```
::= { ospfAreaEntry 7 }
```

ospfAreaLsaChecksumSum OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The 32-bit unsigned 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."
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 areas. It has no effect on other areas.

If it is noAreaSummary, the router will neither originate nor propagate summary LSAs into the stub 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 variable displays the status of the entry. Setting it to 'invalid' has the effect of rendering it inoperative. The internal effect (row removal) is implementation dependent."

```

::= { ospfAreaEntry 10 }

```

-- OSPF Area Default Metric Table

```

--      The OSPF Area Default Metric Table describes the metrics
--      that a default Area Border Router will advertise into a
--      Stub area.

```

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."
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
STATUS current
DESCRIPTION
 "The 32 bit identifier for the Stub Area. On
 creation, this can be derived from the in-
 stance."
::= { ospfStubAreaEntry 1 }

```

ospfStubTOS OBJECT-TYPE
    SYNTAX      TOSType
    MAX-ACCESS   read-only
    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 inter-
        faces to other areas."
    ::= { ospfStubAreaEntry 3 }

ospfStubStatus OBJECT-TYPE
    SYNTAX      RowStatus
    MAX-ACCESS   read-create
    STATUS      current
    DESCRIPTION
        "This variable displays the status of the en-
        try. Setting it to 'invalid' has the effect of
        rendering it inoperative. The internal effect
        (row removal) is implementation dependent."
    ::= { 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 ad-
        vertised as a default route."
    DEFVAL      { ospfMetric }
    ::= { ospfStubAreaEntry 5 }

```

-- OSPF Link State Database

-- The Link State Database contains the Link State
 -- Advertisements from throughout the areas that the
 -- device is attached to.

ospfLsdbTable OBJECT-TYPE

SYNTAX SEQUENCE OF OspfLsdbEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The OSPF Process's Link State Database."

REFERENCE

"OSPF Version 2, Section 12 Link State Adver-
 tisements"

::= { 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

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 }

-- External Link State Advertisements are permitted
 -- for backward compatibility, but should be displayed in
 -- the ospfExtLsdbTable rather than here.

ospfLsdbType OBJECT-TYPE

SYNTAX INTEGER {

routerLink (1),

networkLink (2),

summaryLink (3),

asSummaryLink (4),

asExternalLink (5), -- but see ospfExtLsdbTable

multicastLink (6),

nssaExternalLink (7)

}

MAX-ACCESS read-only

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"

::= { ospfLsdbEntry 2 }

ospfLsdbLsid OBJECT-TYPE

SYNTAX IpAddress

MAX-ACCESS read-only

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

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 }

-- Note that the OSPF Sequence Number is a 32 bit signed
-- 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.

ospfLsdbSequence OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The sequence number field is a signed 32-bit integer. 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

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."

REFERENCE

"OSPF Version 2, Section 12 Link State Advertisements"

::= { ospfLsdbEntry 8 }

-- Address Range Table

-- 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 which is known beyond
 -- its borders.

ospfAreaRangeTable OBJECT-TYPE

SYNTAX SEQUENCE OF OspfAreaRangeEntry

MAX-ACCESS not-accessible

STATUS obsolete

DESCRIPTION

"A range of IP addresses 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"

REFERENCE

"OSPF Version 2, Appendix C.2 Area parameters"

::= { ospf 5 }

ospfAreaRangeEntry OBJECT-TYPE

SYNTAX OspfAreaRangeEntry

MAX-ACCESS not-accessible

STATUS obsolete

DESCRIPTION

"A range of IP addresses 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"

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

STATUS obsolete

DESCRIPTION

"The Area 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

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 variable displays the status of the entry. Setting it to 'invalid' has the effect of rendering it inoperative. The internal effect (row removal) is implementation dependent."

::= { 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

-- The Host/Metric Table indicates what hosts are directly

```
--      attached to the Router, and what metrics and types of
--      service should be advertised for them.
```

ospfHostTable OBJECT-TYPE

SYNTAX SEQUENCE OF OspfHostEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The list of Hosts, and their metrics, that the router will advertise as host routes."

REFERENCE

"OSPF Version 2, Appendix C.6 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."

INDEX { ospfHostIpAddress, ospfHostTOS }

::= { ospfHostTable 1 }

OspfHostEntry ::=

```
SEQUENCE {
    ospfHostIpAddress
        IpAddress,
    ospfHostTOS
        TOSType,
    ospfHostMetric
        Metric,
    ospfHostStatus
        RowStatus,
    ospfHostAreaID
        AreaID
}
```

ospfHostIpAddress OBJECT-TYPE

SYNTAX IpAddress

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The IP Address of the Host."

REFERENCE

"OSPF Version 2, Appendix C.6 Host route parameters"

```
    ters"  
 ::= { ospfHostEntry 1 }
```

ospfHostTOS OBJECT-TYPE

SYNTAX TOSType

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The Type of Service of the route being configured."

REFERENCE

"OSPF Version 2, Appendix C.6 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.6 Host route parameters"

```
 ::= { ospfHostEntry 3 }
```

ospfHostStatus OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This variable displays the status of the entry. Setting it to 'invalid' has the effect of rendering it inoperative. The internal effect (row removal) is implementation dependent."

```
 ::= { ospfHostEntry 4 }
```

ospfHostAreaID OBJECT-TYPE

SYNTAX AreaID

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The Area the Host Entry is to be found within. By default, the area that a subsuming OSPF interface is in, or 0.0.0.0"

REFERENCE

"OSPF Version 2, Appendix C.2 Area parameters"
 ::= { ospfHostEntry 5 }

-- OSPF Interface Table

-- The OSPF Interface Table augments the ipAddrTable
 -- with OSPF specific information.

ospfIfTable OBJECT-TYPE

SYNTAX SEQUENCE OF OspfIfEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The OSPF Interface Table describes the inter-
 faces from the viewpoint of OSPF."

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 inter-
 face from the viewpoint of OSPF."

INDEX { ospfIfIpAddress, ospfAddressLessIf }

::= { ospfIfTable 1 }

OspfIfEntry ::=

SEQUENCE {
 ospfIfIpAddress
 IpAddress,
 ospfAddressLessIf
 Integer32,
 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,
ospfIfAuthType
        INTEGER,
ospfIfAuthKey
        OCTET STRING,
ospfIfStatus
        RowStatus,
ospfIfMulticastForwarding
        INTEGER,
ospfIfDemand
        TruthValue
    }

```

ospfIfIpAddress OBJECT-TYPE

```

SYNTAX      IpAddress
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The IP address of this OSPF interface."
::= { ospfIfEntry 1 }

```

ospfAddressLessIf OBJECT-TYPE

```

SYNTAX      Integer32
MAX-ACCESS  read-only
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. Broad-
        cast 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 in-
        terface 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
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"The estimated number of seconds it takes to transmit a link state update packet over this interface."

DEFVAL { 1 }
::= { ospfIfEntry 7 }

ospfIfRetransInterval OBJECT-TYPE

SYNTAX UpToMaxAge
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."

DEFVAL { 5 }
::= { ospfIfEntry 8 }

ospfIfHelloInterval OBJECT-TYPE

SYNTAX HelloRange
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"The length of time, in seconds, between the Hello packets that the router sends on the in-

terface. This value must be the same for all routers attached to a common network."
 DEFVAL { 10 }
 ::= { ospfIfEntry 9 }

ospfIfRtrDeadInterval OBJECT-TYPE

SYNTAX PositiveInteger

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The number of seconds that a router's Hello packets have not been seen before it's 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

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."
::= { ospfIfEntry 15 }
```

ospfIfAuthKey OBJECT-TYPE

```
SYNTAX      OCTET STRING (SIZE (0..256))
MAX-ACCESS   read-create
STATUS       current
DESCRIPTION   "The Authentication Key.  If the Area's Author-
ization Type is simplePassword, and the key
length is shorter than 8 octets, the agent will
left adjust and zero fill to 8 octets.
```

Note that unauthenticated interfaces need no authentication key, and simple password authentication cannot use a key of more than 8 octets. Larger keys are useful only with authentication mechanisms not specified in this docu-

ment.

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 variable displays the status of the entry. Setting it to 'invalid' has the effect of rendering it inoperative. The internal effect (row removal) is implementation dependent."

```
::= { 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 (hel-

lo supression to FULL neighbors and setting the DoNotAge flag on proogated LSAs) should be performed on this interface."
 DEFVAL { false }
 ::= { ospfIfEntry 19 }

ospfIfAuthType OBJECT-TYPE
 SYNTAX INTEGER (0..255)
 -- none (0),
 -- simplePassword (1)
 -- md5 (2)
 -- reserved for specification by IANA (> 2)
 MAX-ACCESS read-create
 STATUS current
 DESCRIPTION
 "The authentication type specified for an interface. Additional authentication types may be assigned locally."
 REFERENCE
 "OSPF Version 2, Appendix E Authentication"
 DEFVAL { 0 } -- no authentication, by default
 ::= { ospfIfEntry 20 }

-- OSPF Interface Metric Table

-- 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 = $10^8 / \text{ifSpeed}$

-- is the default value. 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

```
ospfIfMetricTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF OspfIfMetricEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The TOS metrics for a non-virtual interface
         identified by the interface index."
    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 in-
         terface identified by the interface index."
    REFERENCE
        "OSPF Version 2, Appendix C.3 Router interface
         parameters"
    INDEX { ospfIfMetricIpAddress,
ospfIfMetricAddressLessIf,
ospfIfMetricTOS }
    ::= { ospfIfMetricTable 1 }
```

```
OspfIfMetricEntry ::=
    SEQUENCE {
        ospfIfMetricIpAddress
            IpAddress,
        ospfIfMetricAddressLessIf
            Integer32,
        ospfIfMetricTOS
            TOSType,
        ospfIfMetricValue
            Metric,
        ospfIfMetricStatus
            RowStatus
```


}

ospfIfMetricIpAddress OBJECT-TYPE

SYNTAX IpAddress

MAX-ACCESS read-only

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 Integer32

MAX-ACCESS read-only

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

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 $10^8 / \text{ifSpeed}$."

::= { ospfIfMetricEntry 4 }

ospfIfMetricStatus OBJECT-TYPE

```
SYNTAX      RowStatus
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
    "This variable displays the status of the en-
    try. Setting it to 'invalid' has the effect of
    rendering it inoperative. The internal effect
    (row removal) is implementation dependent."
::= { ospfIfMetricEntry 5 }
```

```
-- OSPF Virtual Interface Table
```

```
-- The Virtual Interface Table describes the virtual
-- links that the OSPF Process is configured to
-- carry on.
```

```
ospfVirtIfTable OBJECT-TYPE
SYNTAX      SEQUENCE OF OspfVirtIfEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "Information about this router's virtual inter-
    faces."
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."
INDEX { ospfVirtIfAreaId, ospfVirtIfNeighbor }
::= { ospfVirtIfTable 1 }
```

```
OspfVirtIfEntry ::=
SEQUENCE {
    ospfVirtIfAreaId
        AreaID,
    ospfVirtIfNeighbor
        RouterID,
    ospfVirtIfTransitDelay
        UpToMaxAge,
    ospfVirtIfRetransInterval
```

```

        UpToMaxAge,
ospfVirtIfHelloInterval
        HelloRange,
ospfVirtIfRtrDeadInterval
        PositiveInteger,
ospfVirtIfState
        INTEGER,
ospfVirtIfEvents
        Counter32,
ospfVirtIfAuthType
        INTEGER,
ospfVirtIfAuthKey
        OCTET STRING,
ospfVirtIfStatus
        RowStatus
    }

```

ospfVirtIfAreaId OBJECT-TYPE

```

SYNTAX      AreaID
MAX-ACCESS  read-only
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
STATUS      current
DESCRIPTION
    "The Router ID of the Virtual Neighbor."
::= { ospfVirtIfEntry 2 }

```

ospfVirtIfTransitDelay OBJECT-TYPE

```

SYNTAX      UpToMaxAge
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
    "The estimated number of seconds it takes to
    transmit a link- state update packet over this
    interface."
DEFVAL { 1 }
::= { ospfVirtIfEntry 3 }

```

ospfVirtIfRetransInterval OBJECT-TYPE

SYNTAX UpToMaxAge
 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. This value should be well over the expected round-trip time."

DEFVAL { 5 }
 ::= { ospfVirtIfEntry 4 }

ospfVirtIfHelloInterval OBJECT-TYPE

SYNTAX HelloRange
 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
 MAX-ACCESS read-create
 STATUS current
 DESCRIPTION

"The number of seconds that a router's Hello packets have not been seen before it's 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"
    ::= { ospfVirtIfEntry 8 }

```

ospfVirtIfAuthKey OBJECT-TYPE

```

    SYNTAX        OCTET STRING (SIZE(0..256))
    MAX-ACCESS    read-create
    STATUS        current
    DESCRIPTION
        "If Authentication Type is simplePassword, the
         device will left adjust and zero fill to 8 oc-
         tets.

```

Note that unauthenticated interfaces need no authentication key, and simple password authentication cannot use a key of more than 8 octets. Larger keys are useful only with authentication mechanisms not specified in this document.

When read, ospfVifAuthKey always returns a 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 variable displays the status of the entry. Setting it to 'invalid' has the effect of rendering it inoperative. The internal effect (row removal) is implementation dependent."

```
::= { ospfVirtIfEntry 10 }
```

ospfVirtIfAuthType OBJECT-TYPE

```
SYNTAX    INTEGER (0..255)
```

```
-- none (0),
```

```
-- simplePassword (1)
```

```
-- md5 (2)
```

```
-- reserved for specification by IANA (> 2)
```

```
MAX-ACCESS read-create
```

```
STATUS    current
```

DESCRIPTION

"The authentication type specified for a virtual interface. Additional authentication types may be assigned locally."

REFERENCE

"OSPF Version 2, Appendix E Authentication"

```
DEFVAL { 0 }          -- no authentication, by default
```

```
::= { ospfVirtIfEntry 11 }
```

```
-- OSPF Neighbor Table
```

```
-- The OSPF Neighbor Table describes all neighbors in
-- the locality of the subject router.
```

ospfNbrTable OBJECT-TYPE

```
SYNTAX    SEQUENCE OF OspfNbrEntry
```

```
MAX-ACCESS not-accessible
```

```
STATUS    current
```

DESCRIPTION

"A table of non-virtual neighbor information."

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."

REFERENCE

"OSPF Version 2, Section 10 The Neighbor Data Structure"

INDEX { ospfNbrIpAddress, ospfNbrAddressLessIndex }
 ::= { ospfNbrTable 1 }

OspfNbrEntry ::=

SEQUENCE {
 ospfNbrIpAddress
 IpAddress,
 ospfNbrAddressLessIndex
 InterfaceIndex,
 ospfNbrRtrId
 RouterID,
 ospfNbrOptions
 Integer32,
 ospfNbrPriority
 DesignatedRouterPriority,
 ospfNbrState
 INTEGER,
 ospfNbrEvents
 Counter32,
 ospfNbrLsRetransQLen
 Gauge32,
 ospfNbmaNbrStatus
 RowStatus,
 ospfNbmaNbrPermanence
 INTEGER,
 ospfNbrHelloSuppressed
 TruthValue
 }

ospfNbrIpAddress OBJECT-TYPE

SYNTAX IpAddress
 MAX-ACCESS read-only
 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 InterfaceIndex
 MAX-ACCESS read-only

```
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 IpAd-
        dress) 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 op-
        tions 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 informa-
        tion; if zero, it is a stub area.

        Bit 2, if set, indicates that the system is ca-
        pable of routing IP Multicast datagrams; i.e.,
        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 advertise-
```


ments 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."
 ::= { 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 variable displays the status of the en-
    try. Setting it to 'invalid' has the effect of
    rendering it inoperative. The internal effect
    (row removal) is implementation dependent."
 ::= { 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 en-
    try. '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 }

```

```
-- OSPF Virtual Neighbor Table
```

```
--      This table describes all virtual neighbors.
--      Since Virtual Links are configured in the
--      virtual interface table, this table is read-only.
```

```
ospfVirtNbrTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF OspfVirtNbrEntry
    MAX-ACCESS   not-accessible
    STATUS      current
    DESCRIPTION
        "A table of virtual neighbor information."
    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
    }
```

}

ospfVirtNbrArea OBJECT-TYPE

SYNTAX AreaID

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The Transit Area Identifier."

::= { ospfVirtNbrEntry 1 }

ospfVirtNbrRtrId OBJECT-TYPE

SYNTAX RouterID

MAX-ACCESS read-only

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 us-
ing."

::= { ospfVirtNbrEntry 3 }

ospfVirtNbrOptions OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A Bit Mask corresponding to the neighbor's op-
tions 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; ie, that it imple-
ments 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 Relation-
    ship."
::= { 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."
::= { 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 }
```

```
-- OSPF Link State Database, External

--      The Link State Database contains the 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 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.

ospfExtLsdbTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF OspfExtLsdbEntry
    MAX-ACCESS   not-accessible
    STATUS      current
    DESCRIPTION
        "The OSPF Process's Links State Database."
    REFERENCE
        "OSPF Version 2, Section 12 Link State Adver-
        tisements"
    ::= { ospf 12 }

ospfExtLsdbEntry OBJECT-TYPE
    SYNTAX      OspfExtLsdbEntry
    MAX-ACCESS   not-accessible
    STATUS      current
    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
    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"
    ::= { ospfExtLsdbEntry 1 }
```

```
ospfExtLsdbLsid OBJECT-TYPE
    SYNTAX      IpAddress
    MAX-ACCESS   read-only
    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"
    ::= { ospfExtLsdbEntry 2 }
```

```
ospfExtLsdbRouterId OBJECT-TYPE
    SYNTAX      RouterID
    MAX-ACCESS   read-only
    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"
    ::= { ospfExtLsdbEntry 3 }
```

```
-- Note that the OSPF Sequence Number is a 32 bit signed
-- 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.
```

`ospfExtLsdbSequence OBJECT-TYPE``SYNTAX Integer32``MAX-ACCESS read-only``STATUS current``DESCRIPTION`

"The sequence number field is a signed 32-bit integer. 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``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"

`::= { ospfExtLsdbEntry 5 }``ospfExtLsdbChecksum 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"

`::= { ospfExtLsdbEntry 6 }``ospfExtLsdbAdvertisement OBJECT-TYPE`


```

SYNTAX      OCTET STRING (SIZE(36))
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
    "The entire Link State Advertisement, including
    its header."
REFERENCE
    "OSPF Version 2, Section 12 Link State Adver-
    tisements"
 ::= { 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

"A range of IP addresses 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 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 range of IP addresses 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 if ranges are range 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"

```
INDEX { ospfAreaAggregateAreaID, ospfAreaAggregateLsdbType,
        ospfAreaAggregateNet, ospfAreaAggregateMask }
 ::= { ospfAreaAggregateTable 1 }
```

OspfAreaAggregateEntry ::=

```
SEQUENCE {
    ospfAreaAggregateAreaID
        AreaID,
    ospfAreaAggregateLsdbType
        INTEGER,
    ospfAreaAggregateNet
        IpAddress,
    ospfAreaAggregateMask
        IpAddress,
    ospfAreaAggregateStatus
        RowStatus,
    ospfAreaAggregateEffect
        INTEGER
}
```

ospfAreaAggregateAreaID OBJECT-TYPE

SYNTAX AreaID

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The Area the Address Aggregate is to be found within."

REFERENCE

"OSPF Version 2, Appendix C.2 Area parameters"

```
::= { ospfAreaAggregateEntry 1 }
```

ospfAreaAggregateLsdbType OBJECT-TYPE

```
SYNTAX INTEGER {
    summaryLink (3),
    nssaExternalLink (7)
}
```

MAX-ACCESS read-only

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
    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
    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 variable displays the status of the en-
        try. Setting it to 'invalid' has the effect of
        rendering it inoperative. The internal effect
        (row removal) is implementation dependent."
 ::= { 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 }
```

-- conformance information

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

```
ospfGroups OBJECT IDENTIFIER ::= { ospfConformance 1 }
```

```
ospfCompliances OBJECT IDENTIFIER ::= { ospfConformance 2 }
```

-- compliance statements

```
ospfCompliance MODULE-COMPLIANCE
  STATUS current
  DESCRIPTION
    "The compliance statement "
  MODULE -- this module
  MANDATORY-GROUPS {
    ospfBasicGroup,
    ospfAreaGroup,
    ospfStubAreaGroup,
    ospfIfGroup,
    ospfIfMetricGroup,
    ospfVirtIfGroup,
    ospfNbrGroup,
    ospfVirtNbrGroup,
    ospfAreaAggregateGroup
  }
  ::= { ospfCompliances 1 }
```

-- units of conformance

```
ospfBasicGroup OBJECT-GROUP
  OBJECTS {
    ospfRouterId,
    ospfAdminStat,
    ospfVersionNumber,
    ospfAreaBdrRtrStatus,
    ospfASBdrRtrStatus,
    ospfExternLsaCount,
    ospfExternLsaChecksumSum,
```

```

        ospfTOSSupport,
        ospfOriginateNewLsas,
        ospfRxNewLsas,
        ospfExtLsdbLimit,
        ospfMulticastExtensions,
        ospfExitOverflowInterval,
        ospfDemandExtensions
    }
    STATUS current
    DESCRIPTION
        "These objects are required for OSPF systems."
    ::= { ospfGroups 1 }

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

ospfStubAreaGroup  OBJECT-GROUP
    OBJECTS {
        ospfStubAreaId,
        ospfStubTOS,
        ospfStubMetric,
        ospfStubStatus,
        ospfStubMetricType
    }
    STATUS current
    DESCRIPTION
        "These objects are required 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 required 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 required for non-CIDR OSPF
    systems that support multiple areas."
  ::= { ospfGroups 5 }
```

```
ospfHostGroup       OBJECT-GROUP
  OBJECTS {
    ospfHostIpAddress,
    ospfHostTOS,
    ospfHostMetric,
    ospfHostStatus,
    ospfHostAreaID
  }
  STATUS      current
  DESCRIPTION
    "These objects are required 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      current
  DESCRIPTION
    "These objects are required for OSPF systems."
  ::= { ospfGroups 7 }
```

```
ospfIfMetricGroup  OBJECT-GROUP
  OBJECTS {
    ospfIfMetricIpAddress,
    ospfIfMetricAddressLessIf,
    ospfIfMetricTOS,
    ospfIfMetricValue,
    ospfIfMetricStatus
  }
  STATUS      current
  DESCRIPTION
    "These objects are required for OSPF systems."
  ::= { ospfGroups 8 }
```

```
ospfVirtIfGroup    OBJECT-GROUP
  OBJECTS {
    ospfVirtIfAreaId,
    ospfVirtIfNeighbor,
    ospfVirtIfTransitDelay,
```



```

        ospfVirtIfRetransInterval,
        ospfVirtIfHelloInterval,
        ospfVirtIfRtrDeadInterval,
        ospfVirtIfState,
        ospfVirtIfEvents,
        ospfVirtIfAuthType,
        ospfVirtIfAuthKey,
        ospfVirtIfStatus
    }
    STATUS current
    DESCRIPTION
        "These objects are required for OSPF systems."
    ::= { ospfGroups 9 }

```

```

ospfNbrGroup      OBJECT-GROUP
    OBJECTS {
        ospfNbrIpAddress,
        ospfNbrAddressLessIndex,
        ospfNbrRtrId,
        ospfNbrOptions,
        ospfNbrPriority,
        ospfNbrState,
        ospfNbrEvents,
        ospfNbrLsRetransQLen,
        ospfNbmaNbrStatus,
        ospfNbmaNbrPermanence,
        ospfNbrHelloSuppressed
    }
    STATUS current
    DESCRIPTION
        "These objects are required for OSPF systems."
    ::= { ospfGroups 10 }

```

```

ospfVirtNbrGroup  OBJECT-GROUP
    OBJECTS {
        ospfVirtNbrArea,
        ospfVirtNbrRtrId,
        ospfVirtNbrIpAddress,
        ospfVirtNbrOptions,
        ospfVirtNbrState,
        ospfVirtNbrEvents,
        ospfVirtNbrLsRetransQLen,
        ospfVirtNbrHelloSuppressed
    }
    STATUS current
    DESCRIPTION

```

```

    "These objects are required for OSPF systems."
    ::= { ospfGroups 11 }

```

```

ospfExtLsdbGroup      OBJECT-GROUP
    OBJECTS {
        ospfExtLsdbType,
        ospfExtLsdbLsid,
        ospfExtLsdbRouterId,
        ospfExtLsdbSequence,
        ospfExtLsdbAge,
        ospfExtLsdbChecksum,
        ospfExtLsdbAdvertisement
    }
    STATUS      current
    DESCRIPTION
        "These objects are required for OSPF systems
        that display their link state database."
    ::= { ospfGroups 12 }

```

```

ospfAreaAggregateGroup  OBJECT-GROUP
    OBJECTS {
        ospfAreaAggregateAreaID,
        ospfAreaAggregateLsdbType,
        ospfAreaAggregateNet,
        ospfAreaAggregateMask,
        ospfAreaAggregateStatus,
        ospfAreaAggregateEffect
    }
    STATUS      current
    DESCRIPTION
        "These objects are required for OSPF systems."
    ::= { ospfGroups 13 }

```

END

4. OSPF Traps

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 of routers. Another approach is to notify a network manager of potentially critical OSPF events with SNMP traps.

This section defines a set of traps, objects and mechanisms to enhance the ability to manage IP internetworks which use OSPF as its IGP. It is an optional but useful extension to the OSPF MIB.

4.1. Format Of Trap Definitions

Section 7 contains contains the trap definitions.

4.2. Approach

The mechanism for sending traps is straight-forward. 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. A new object is defined in section 3.2 that will allow a network manager to enable or disable particular OSPF traps. 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`, `ospfTxRetranmit` 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 [11], section 5. The basic idea is that there is a sliding window in seconds and an upper bound on the number of traps that may be generated within this window. 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 traps types except for the `ospfLsdbOverflow` and the `ospfLsdbApproachingOverflow` trap which should not be throttled. For example, if the window time is 3, the upper bound is 3 and the events that would cause trap types 1,3,5 and 7 occur within a 3 second period, the type 7 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 defined in section 5.

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

5. OSPF Trap Definitions

OSPF-TRAP-MIB DEFINITIONS ::= BEGIN

IMPORTS

MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE, IPAddress
FROM SNMPv2-SMI
MODULE-COMPLIANCE, OBJECT-GROUP
FROM SNMPv2-CONF
ospfRouterId, ospfIfIpAddress, ospfAddressLessIf, ospfIfState,
ospfVirtIfAreaId, ospfVirtIfNeighbor, ospfVirtIfState,
ospfNbrIpAddr, ospfNbrAddressLessIndex, ospfNbrRtrId,
ospfNbrState, ospfVirtNbrArea, ospfVirtNbrRtrId, ospfVirtNbrStat
e,
ospfLsdbType, ospfLsdbLsid, ospfLsdbRouterId, ospfLsdbAreaId,
ospfExtLsdbLimit, ospf
FROM OSPF-MIB;

ospfTrap MODULE-IDENTITY

LAST-UPDATED "9501201225Z" -- Fri Jan 20 12:25:50 PST 1995
ORGANIZATION "IETF OSPF Working Group"
CONTACT-INFO
"
Postal: Fred Baker
Cisco Systems
519 Lado Drive
Santa Barbara, California 93111
Tel: +1 805 681 0115
E-Mail: fred@cisco.com

Rob Coltun
Postal: RainbowBridge Communications
Tel: (301) 340-9416
E-Mail: rcoltun@rainbow-bridge.com"

DESCRIPTION

"The MIB module to describe traps for the OSPF
Version 2 Protocol."
::= { 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 four-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."

::= { 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) }

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Potential types of configuration conflicts. Used by the ospfConfigError and ospfConfigVirtualError traps."

::= { ospfTrapControl 2 }

ospfPacketType OBJECT-TYPE

SYNTAX INTEGER {
 hello (1),
 dbDescript (2),
 lsReq (3),
 lsUpdate (4),
 lsAck (5) }

MAX-ACCESS read-only

STATUS current

DESCRIPTION

```

    "OSPF packet types."
 ::= { ospfTrapControl 3 }

```

```

ospfPacketSrc OBJECT-TYPE
    SYNTAX      IPAddress
    MAX-ACCESS   read-only
    STATUS      current
    DESCRIPTION
        "The IP address of an inbound packet that can-
         not be identified by a neighbor instance."
 ::= { ospfTrapControl 4 }

```

```
-- Traps
```

```

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 }

```

```

ospfVirtIfStateChange NOTIFICATION-TYPE
    OBJECTS {
        ospfRouterId, -- The originator of the trap
        ospfVirtIfAreaId,
        ospfVirtIfNeighbor,
        ospfVirtIfState -- The new state
    }
    STATUS      current
    DESCRIPTION
        "An ospfIfStateChange trap signifies that there
         has been a change in the state of an OSPF vir-
         tual 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 ospfIfStateChange 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 ospfConfigError 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 in-
    terface 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 au-
    thentication 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 ospfRxBadPacket 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 re-
    transmitted 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 ospfTxRetransmit 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 LSA 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 data-
       base 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 }

-- conformance information

ospfTrapConformance OBJECT IDENTIFIER ::= { ospfTrap 3 }

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

-- compliance statements

ospfTrapCompliance MODULE-COMPLIANCE
  STATUS current
  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 }

-- 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 }

END
```

6. Acknowledgements

This document was produced by the OSPF Working Group.

7. References

- [1] Cerf, V., "IAB Recommendations for the Development of Internet Network Management Standards", RFC 1052, NRI, April 1988.
- [2] Cerf, V., "Report of the Second Ad Hoc Network Management Review Group", RFC 1109, NRI, August 1989.
- [3] Rose M., and K. McCloghrie, "Structure and Identification of Management Information for TCP/IP-based internets", STD 16, RFC 1155, Performance Systems International, Hughes LAN Systems, May 1990.
- [4] McCloghrie K., and M. Rose, "Management Information Base for Network Management of TCP/IP-based internets", RFC 1156, Hughes LAN Systems, Performance Systems International, May 1990.
- [5] Case, J., Fedor, M., Schoffstall, M., and J. Davin, "Simple Network Management Protocol", STD 15, RFC 1157, SNMP Research, Performance Systems International, Performance Systems International, MIT Laboratory for Computer Science, May 1990.

- [6] Rose M., Editor, "Management Information Base for Network Management of TCP/IP-based internets: MIB-II", STD 17, RFC 1213, Performance Systems International, March 1991.
- [7] Information processing systems - Open Systems Interconnection - Specification of Abstract Syntax Notation One (ASN.1), International Organization for Standardization, International Standard 8824, December 1987.
- [8] Information processing systems - Open Systems Interconnection - Specification of Basic Encoding Rules for Abstract Notation One (ASN.1), International Organization for Standardization, International Standard 8825, December 1987.
- [9] Rose, M., and K. McCloghrie, Editors, "Concise MIB Definitions", STD 16, RFC 1212, Performance Systems International, Hughes LAN Systems, March 1991.
- [10] Rose, M., Editor, "A Convention for Defining Traps for use with the SNMP", RFC 1215, Performance Systems International, March 1991.
- [11] Steinberg, L., "Techniques for Managing Asynchronously Generated Alerts", RFC 1224, IBM Corporation, May 1991.
- [12] Moy, J., "Multicast Extensions to OSPF", RFC 1584, Proteon, Inc., September 1993.

8. Security Considerations

Security issues are not discussed in this memo.

9. Authors' Addresses

Fred Baker
cisco Systems, Inc.
519 Lado Drive
Santa Barbara, CA 93111

Phone: (805) 681-0115
EMail: fred@cisco.com

Rob Coltun
RainbowBridge Communications

Phone: (301) 340-9416
EMail: rcoltun@rainbow-bridge.com

