OSPF Version 2 Management Information Base

Status of this Memo

This RFC specifies an IAB standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "IAB Official Protocol Standards" for the standardization state and status of this protocol. This memo replaces RFC 1248 which contained some minor errors in referring to "experimental" and "standard-mib" in Section 5. Distribution of this memo is unlimited.

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1. 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 OSPF Version 2.

2. The Network Management Framework

The Internet-standard Network Management Framework consists of three components. They are:

- **RFC 1155** which defines the SMI, the mechanisms used for describing and naming objects for the purpose of management. **RFC 1212** defines a more concise description mechanism, which is wholly consistent with the SMI.

- **RFC 1156** which defines MIB-I, the core set of managed objects for the Internet suite of protocols. **RFC 1213**, defines MIB-II, an evolution of MIB-I based on implementation experience and new operational requirements.

- **RFC 1157** which defines the SNMP, the protocol used for network access to managed objects.

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

3. Objects

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) [7] defined in the SMI. In particular, each object has a name, a syntax, and an encoding. The name is an object identifier, an administratively assigned name, which specifies an object type. 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 OBJECT DESCRIPTOR, to also refer to the object type.

The syntax of an object type defines the abstract data structure corresponding to that object type. The ASN.1 language is used for
this purpose. However, the SMI [3] purposely restricts the ASN.1 constructs which may be used. These restrictions are explicitly made for simplicity.

The encoding of an object type is simply how that object type is represented using the object type’s syntax. Implicitly tied to the notion of an object type’s syntax and encoding is how the object type is represented when being transmitted on the network.

The SMI specifies the use of the basic encoding rules of ASN.1 [8], subject to the additional requirements imposed by the SNMP.

3.1. Format of Definitions

Section 5 contains the specification of all object types contained in this MIB module. The object types are defined using the conventions defined in the SMI, as amended by the extensions specified in [9].

4. Overview

4.1. 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, TruthValue, Status, Validation, PositiveInteger, HelloRange, UpToMaxAge, InterfaceIndex, and DesignatedRouterPriority.

4.2. 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

4.2.1. General Variables

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

4.2.2. 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).

4.2.3. Link State Database

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

4.2.4. Address Table and Host Tables

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

4.2.5. 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.

4.2.6. Virtual Interface Table

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

4.2.7. Neighbor and Virtual Neighbor Tables

The Neighbor Table and the Virtual Neighbor Table describe the neighbors to the OSPF Process.
4.3. 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 5, 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 Counter or Gauge.

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.

4.4. 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.

5. Definitions

RFC1252-MIB DEFINITIONS ::= BEGIN

IMPORTS
  Counter, Gauge, IpAddress
  FROM RFC1155-SMI
  mib-2
  FROM RFC1213-MIB
  OBJECT-TYPE
  FROM RFC-1212;

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

ospf OBJECT IDENTIFIER ::= { mib-2 13 }

-- 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 ::= IpAddress

-- The Router ID, in OSPF, has the same format as an IP Address,
-- but identifies the router independent of its IP Address.

RouterID ::= IpAddress

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

Metric ::= INTEGER (1..'FFFF'h)
BigMetric ::= INTEGER (1..'FFFFFF'h)

-- Boolean Values

TruthValue ::= INTEGER { true (1), false (2) }

-- Status Values

Status ::= INTEGER { enabled (1), disabled (2) }
-- Row Creation/Deletion Values

Validation ::= INTEGER { valid (1), invalid (2) }

-- Time Durations measured in seconds

PositiveInteger ::= INTEGER (1..'FFFFFFFFFF'h)
HelloRange    ::= INTEGER (1..'FFFF'h)
UpToMaxAge    ::= INTEGER (1..3600)

-- The range of ifIndex, i.e. (1..ifNumber)

InterfaceIndex ::= INTEGER

-- Potential Priorities for the Designated Router Election

DesignatedRouterPriority ::= INTEGER (0..'FF'h)

-- Type of Service is defined as a mapping to the IP Type of
-- Service Flags as defined in the Router Requirements
-- Document:

-- D => Low Delay    R => Reliable Route
-- T => High Bandwidth

-- D T R    TOS     D T R    TOS
-- 0 0 0 => 0 0 1 => 4
-- 0 1 0 => 8 0 1 1 => 12
-- 1 0 0 => 16 1 0 1 => 20
-- 1 1 0 => 24 1 1 1 => 28

-- The remaining values are left for future definition.

TOSType ::= INTEGER (0..31)

-- OSPF General Variables

-- These parameters apply globally to the Router’s
-- OSPF Process.

ospfGeneralGroup OBJECT IDENTIFIER ::= { ospf 1 }

ospfRouterId OBJECT-TYPE
SYNTAX   RouterID
ACCESS   read-write
STATUS   mandatory
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
ACCESS read-write
STATUS mandatory
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) }
ACCESS read-only
STATUS mandatory
DESCRIPTION
"The current version number of the OSPF protocol is 2."
REFERENCE
"OSPF Version 2, Title"
::= { ospfGeneralGroup 3 }

ospfAreaBdrRtrStatus OBJECT-TYPE
SYNTAX TruthValue
ACCESS read-only
STATUS mandatory
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
ACCESS read-write
STATUS mandatory
DESCRIPTION
"A flag to note whether this router is an Autonomous System border router."
REFERENCE
"OSPF Version 2, Section 3.3 Classification of routers"
::= { ospfGeneralGroup 5 }

ospfExternLSACount OBJECT-TYPE
SYNTAX   Gauge
ACCESS   read-only
STATUS   mandatory
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   INTEGER
ACCESS   read-only
STATUS   mandatory
DESCRIPTION
"The 32-bit unsigned sum of the LS checksums of the external link-state advertisements contained in the link-state database. This sum can be used to determine if there has been a change in a router’s link state database, and to compare the link-state database of two routers."
::= { ospfGeneralGroup 7 }

ospfTOSSupport OBJECT-TYPE
SYNTAX   TruthValue
ACCESS   read-write
STATUS   mandatory
DESCRIPTION
"The router’s support for type-of-service routing."
REFERENCE
"OSPF Version 2, Appendix F.1.2 Optional TOS support"
::= { ospfGeneralGroup 8 }

ospfOriginNewLSAs OBJECT-TYPE
SYNTAX   Counter
ACCESS   read-only
STATUS   mandatory
DESCRIPTION
"The number of new link-state advertisements that have been originated. This number is incremented each time the router originates a new LSA."
::= { ospfGeneralGroup 9 }
ospfRxNewLSAs OBJECT-TYPE
SYNTAX   Counter
ACCESS   read-only
STATUS   mandatory
DESCRIPTION
 "The number of link-state advertisements received
determined to be new instantiations. This number does
not include newer instantiations of self-originated
link-state advertisements."
::= { ospfGeneralGroup 10 }

--      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
ACCESS   not-accessible
STATUS   mandatory
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
ACCESS   not-accessible
STATUS   mandatory
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
    INTEGER,
    ospfImportASExtern
    TruthValue,
    ospfSpfRuns
    }
Counter,
ospfAreaBdrRtrCount
Gauge,
ospfASBdrRtrCount
Gauge,
ospfLSACount
Gauge,
ospfAreaLSACKsumSum
INTEGER
}

ospfAreaId OBJECT-TYPE
SYNTAX AreaID
ACCESS read-write
STATUS mandatory
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 INTEGER
-- none (0),
-- simplePassword (1)
-- reserved for specification by IANA (> 1)
ACCESS read-write
STATUS mandatory
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 TruthValue
ACCESS read-write
STATUS mandatory
DESCRIPTION "The area’s support for importing AS external link-state advertisements."
REFERENCE "OSPF Version 2, Appendix C.2 Area parameters"
DEFVAL { true }
::= { ospfAreaEntry 3 }

ospfSpfRuns OBJECT-TYPE
SYNTAX Counter
ACCESS read-only
STATUS mandatory
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."
DEFVAL { 0 }
::= { ospfAreaEntry 4 }

ospfAreaBdrRtrCount OBJECT-TYPE
SYNTAX Gauge
ACCESS read-only
STATUS mandatory
DESCRIPTION
"The total number of area border routers reachable within this area. This is initially zero, and is calculated in each SPF Pass."
DEFVAL { 0 }
::= { ospfAreaEntry 5 }

ospfASBdrRtrCount OBJECT-TYPE
SYNTAX Gauge
ACCESS read-only
STATUS mandatory
DESCRIPTION
"The total number of Autonomous System border routers reachable within this area. This is initially zero, and is calculated in each SPF Pass."
DEFVAL { 0 }
::= { ospfAreaEntry 6 }

ospfAreaLSACount OBJECT-TYPE
SYNTAX Gauge
ACCESS read-only
STATUS mandatory
DESCRIPTION
"The total number of link-state advertisements in this area’s link-state database, excluding AS External LSA’s."
DEFVAL { 0 }
::= { ospfAreaEntry 7 }
ospfAreaLSAcksumSum OBJECT-TYPE
SYNTAX INTEGER
ACCESS read-only
STATUS mandatory
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 }

-- 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
ACCESS not-accessible
STATUS mandatory
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
ACCESS not-accessible
STATUS mandatory
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 
      Validation 
  }

ospfStubAreaID OBJECT-TYPE
SYNTAX  AreaID
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
  "The 32 bit identifier for the Stub Area. On creation, this can be derived from the instance."
::= { ospfStubAreaEntry 1 }

ospfStubTOS OBJECT-TYPE
SYNTAX  TOSType
ACCESS  read-write
STATUS  mandatory
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
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
  "The metric value applied at the indicated type of service. By default, this equals the least metric at the type of service among the interfaces to other areas."
::= { ospfStubAreaEntry 3 }

ospfStubStatus OBJECT-TYPE
SYNTAX  Validation
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
  "This variable displays the validity or invalidity of
the entry. Setting it to 'invalid' has the effect of rendering it inoperative. The internal effect (row removal) is implementation dependent."

DEFVAL   { valid }
::= { ospfStubAreaEntry 4 }

-- 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
ACCESS   not-accessible
STATUS   mandatory
DESCRIPTION
   "The OSPF Process’s Links State Database."
REFERENCE
   "OSPF Version 2, Section 12 Link State Advertisements"
::= { ospf 4 }

ospfLsdbEntry OBJECT-TYPE
SYNTAX   OspfLsdbEntry
ACCESS   not-accessible
STATUS   mandatory
DESCRIPTION
   "A single Link State Advertisement."
INDEX { ospfLsdbAreaId, ospfLsdbType,
       ospfLsdbLSID, ospfLsdbRouterId }
::= { ospfLsdbTable 1 }

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

ospfLsdbAreaId OBJECT-TYPE
SYNTAX AreaID
ACCESS read-only
STATUS mandatory
DESCRIPTION
"The 32 bit identifier of the Area from which the LSA
was received."
REFERENCE
"OSPF Version 2, Appendix C.2 Area parameters"
::= { ospfLsdbEntry 1 }

ospfLsdbType OBJECT-TYPE
SYNTAX INTEGER {
    routerLink (1),
    networkLink (2),
    summaryLink (3),
    asSummaryLink (4),
    asExternalLink (5)
}
ACCESS read-only
STATUS mandatory
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
ACCESS read-only
STATUS mandatory
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
ACCESS     read-only
STATUS     mandatory
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    INTEGER
ACCESS     read-only
STATUS     mandatory
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    INTEGER    -- Should be 0..MaxAge
ACCESS     read-only
STATUS     mandatory
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    INTEGER
ACCESS     read-only
STATUS     mandatory
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
ACCESS read-only
STATUS mandatory
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
ACCESS not-accessible
STATUS mandatory
DESCRIPTION "A range if 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
ACCESS not-accessible
STATUS mandatory
DESCRIPTION "A range if 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           Validation
}

ospfAreaRangeAreaID OBJECT-TYPE
SYNTAX   AreaID
ACCESS   read-write
STATUS   mandatory
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
ACCESS   read-write
STATUS   mandatory
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
ACCESS   read-write
STATUS   mandatory
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 Validation
ACCESS read-write
STATUS mandatory
DESCRIPTION
"This variable displays the validity or invalidity of
the entry. Setting it to 'invalid' has the effect of
rendering it inoperative. The internal effect (row
removal) is implementation dependent."
DEFVAL { valid }
::= { ospfAreaRangeEntry 4 }

-- 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
ACCESS not-accessible
STATUS mandatory
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
ACCESS not-accessible
STATUS mandatory
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
Validation

ospfHostIpAddress OBJECT-TYPE
SYNTAX   IpAddress
ACCESS   read-write
STATUS   mandatory
DESCRIPTION
"The IP Address of the Host."
REFERENCE
"OSPF Version 2, Appendix C.6 Host route parameters"
 ::= { ospfHostEntry 1 }

ospfHostTOS OBJECT-TYPE
SYNTAX   TOSType
ACCESS   read-write
STATUS   mandatory
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
ACCESS   read-write
STATUS   mandatory
DESCRIPTION
"The Metric to be advertised."
REFERENCE
"OSPF Version 2, Appendix C.6 Host route parameters"
 ::= { ospfHostEntry 3 }

ospfHostStatus OBJECT-TYPE
SYNTAX   Validation
ACCESS   read-write
STATUS   mandatory
DESCRIPTION
"This variable displays the validity or invalidity of the entry. Setting it to 'invalid' has the effect of rendering it inoperative. The internal effect (row removal) is implementation dependent."
DEFVAL   { valid }
 ::= { ospfHostEntry 4 }
-- OSPF Interface Table

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

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

ospfIfEntry OBJECT-TYPE
SYNTAX   OspfIfEntry
ACCESS   not-accessible
STATUS   mandatory
DESCRIPTION
   "The OSPF Interface Entry describes one interface from the viewpoint of OSPF."
INDEX { ospfIfIpAddress, ospfAddressLessIf }
::= { ospfIfTable 1 }

OspfIfEntry ::= SEQUENCE {
    ospfIfIpAddress   IpAddress,
    ospfAddressLessIf INTEGER,
    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
   Counter,
ospfIfAuthKey
   OCTET STRING
}

ospfIfIpAddress OBJECT-TYPE
SYNTAX   IpAddress
ACCESS   read-write
STATUS   mandatory
DESCRIPTION
   "The IP address of this OSPF interface."
 ::= { ospIfEntry 1 }

ospfAddressLessIf OBJECT-TYPE
SYNTAX   INTEGER
ACCESS   read-write
STATUS   mandatory
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."
 ::= { ospIfEntry 2 }

ospfIfAreaId OBJECT-TYPE
SYNTAX   AreaID
ACCESS   read-write
STATUS   mandatory
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
 ::= { ospIfEntry 3 }
ospfIfType OBJECT-TYPE
SYNTAX INTEGER {
broadcast (1),
  nbma (2),
  pointToPoint (3)
}
ACCESS read-write
STATUS mandatory
DESCRIPTION
"The OSPF interface type.

By way of a default, this field may be intuited from the corresponding value of ifType. Broadcast LANs, such as Ethernet and IEEE 802.5, take the value 'broadcast', X.25, Frame Relay, 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
ACCESS read-write
STATUS mandatory
DESCRIPTION
"The OSPF interface’s administrative status. The value 'enabled' denotes that neighbor relationships may be formed on the interface, and the interface will be advertised as an internal route to some area. The value 'disabled' denotes that the interface is external to OSPF."
DEFVAL { enabled }
 ::= { ospfIfEntry 5 }

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

ospfIfRtrDeadInterval OBJECT-TYPE
SYNTAX   PositiveInteger
ACCESS   read-write
STATUS   mandatory
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
   ACCESS   read-write
   STATUS   mandatory
   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)
   }
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
   "The OSPF Interface State."
   DEFVAL { down }
   ::= { ospfIfEntry 12 }

ospfIfDesignatedRouter OBJECT-TYPE
   SYNTAX   IpAddress
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
   "The IP Address of the Designated Router."
   DEFVAL { "00000000'H } -- 0.0.0.0
   ::= { ospfIfEntry 13 }

ospfIfBackupDesignatedRouter OBJECT-TYPE
   SYNTAX   IpAddress
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
   "The IP Address of the Backup Designated Router."
   DEFVAL { "00000000'H } -- 0.0.0.0
   ::= { ospfIfEntry 14 }
ospfIfEvents OBJECT-TYPE
SYNTAX Counter
ACCESS read-only
STATUS mandatory
DESCRIPTION
"The number of times this OSPF interface has changed its state, or an error has occurred."
DEFVAL { 0 }
 ::= { ospfIfEntry 15 }

ospfIfAuthKey OBJECT-TYPE
SYNTAX OCTET STRING
ACCESS read-write
STATUS mandatory
DESCRIPTION
"The Authentication Key. If the Area’s Authorization Type is simplePassword, and the key length is shorter than 8 octets, the agent will left adjust and zero fill to 8 octets.

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 }

-- 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 / 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
ACCESS    not-accessible
STATUS    mandatory
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
ACCESS    not-accessible
STATUS    mandatory
DESCRIPTION
    "A particular TOS metric for a non-virtual interface
    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
    INTEGER,
    ospfIfMetricTOS
    TOSType,
ospfIfMetricMetric
   Metric,
ospfIfMetricStatus
   Validation

ospfIfMetricIpAddress OBJECT-TYPE
SYNTAX   IpAddress
ACCESS   read-write
STATUS   mandatory
DESCRIPTION
   "The IP address of this OSPF interface. On row
creation, this can be derived from the instance."
::= { ospfIfMetricEntry 1 }

ospfIfMetricAddressLessIf OBJECT-TYPE
SYNTAX   INTEGER
ACCESS   read-write
STATUS   mandatory
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
ACCESS   read-write
STATUS   mandatory
DESCRIPTION
   "The type of service metric being referenced. On row
creation, this can be derived from the instance."
::= { ospfIfMetricEntry 3 }

ospfIfMetricMetric OBJECT-TYPE
SYNTAX   Metric
ACCESS   read-write
STATUS   mandatory
DESCRIPTION
   "The metric of using this type of service on this
interface. The default value of the TOS 0 Metric is
10^8 / ifSpeed.

The value FFFF is distinguished to mean ‘no route via
this TOS’.
::= { ospfIfMetricEntry 4 }
ospfIfMetricStatus OBJECT-TYPE
SYNTAX   Validation
ACCESS   read-write
STATUS   mandatory
DESCRIPTION
"This variable displays the validity or invalidity of
the entry. Setting it to 'invalid' has the effect of
rendering it inoperative. The internal effect (row
removal) is implementation dependent."
DEFVAL   { valid }
 ::= { 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
ACCESS   not-accessible
STATUS   mandatory
DESCRIPTION
"Information about this router’s virtual interfaces."
REFERENCE
"OSPF Version 2, Appendix C.4 Virtual link parameters"
 ::= { ospf 9 }

OspfVirtIfEntry OBJECT-TYPE
SYNTAX   OspfVirtIfEntry
ACCESS   not-accessible
STATUS   mandatory
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
   Counter,
ospfVirtIfAuthKey
   OCTET STRING,
ospfVirtIfStatus
   Validation
}

ospfVirtIfAreaID OBJECT-TYPE
SYNTAX   AreaID
ACCESS   read-write
STATUS   mandatory
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
ACCESS   read-write
STATUS   mandatory
DESCRIPTION
   "The Router ID of the Virtual Neighbor."
::= { ospfVirtIfEntry 2 }

ospfVirtIfTransitDelay OBJECT-TYPE
SYNTAX   UpToMaxAge
ACCESS   read-write
STATUS   mandatory
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
ACCESS   read-write
STATUS   mandatory
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
ACCESS   read-write
STATUS   mandatory
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
ACCESS   read-write
STATUS   mandatory
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
}
ACCESS   read-only
STATUS   mandatory
DESCRIPTION
"OSPF virtual interface states."
DEFVAL { down }
::= { ospfVirtIfEntry 7 }

ospfVirtIfEvents OBJECT-TYPE
SYNTAX   Counter
ACCESS   read-only
STATUS   mandatory
DESCRIPTION
"The number of state changes or error events on this Virtual Link"
DEFVAL  { 0 }
 ::= { ospfVirtIfEntry 8 }

ospfVirtIfAuthKey OBJECT-TYPE
SYNTAX   OCTET STRING
ACCESS   read-write
STATUS   mandatory
DESCRIPTION
 "If Authentication Type is simplePassword, the device will left adjust and zero fill to 8 octets.
 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   Validation
ACCESS   read-write
STATUS   mandatory
DESCRIPTION
 "This variable displays the validity or invalidity of the entry. Setting it to 'invalid' has the effect of rendering it inoperative. The internal effect (row removal) is implementation dependent."
DEFVAL  { valid }
 ::= { ospfVirtIfEntry 10 }

-- OSPF Neighbor Table

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

ospfNbrTable OBJECT-TYPE
SYNTAX   SEQUENCE OF OspfNbrEntry
ACCESS   not-accessible
STATUS   mandatory
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
ACCESS not-accessible
STATUS mandatory
DESCRIPTION "The information regarding a single neighbor."
REFERENCE "OSPF Version 2, Section 10 The Neighbor Data Structure"
INDEX { ospfNbrIpAddr, ospfNbrAddressLessIndex }
::= { ospfNbrTable 1 }

OspfNbrEntry ::= SEQUENCE {
    ospfNbrIpAddr IpAddress,
    ospfNbrAddressLessIndex InterfaceIndex,
    ospfNbrRtrId RouterID,
    ospfNbrOptions INTEGER,
    ospfNbrPriority DesignatedRouterPriority,
    ospfNbrState INTEGER,
    ospfNbrEvents Counter,
    ospfNbrLSRetransQLen Gauge,
    ospfNBMANbrStatus Validation
}

ospfNbrIpAddr OBJECT-TYPE
SYNTAX IpAddress
ACCESS read-write
STATUS mandatory
DESCRIPTION "The IP address of this neighbor."
::= { ospfNbrEntry 1 }

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

ospfNbrOptions OBJECT-TYPE
SYNTAX   INTEGER
ACCESS   read-only
STATUS   mandatory
DESCRIPTION
"A Bit Mask corresponding to the neighbor’s options field.

Bit 0, if set, indicates that the area accepts and operates on external information; if zero, it is a stub area.

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."
REFERENCE
"OSPF Version 2, Section 12.1.2 Options"
DEFVAL { 0 }
::= { ospfNbrEntry 4 }

ospfNbrPriority OBJECT-TYPE
SYNTAX   DesignatedRouterPriority
ACCESS   read-write
STATUS   mandatory
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)
}
ACCESS read-only
STATUS mandatory
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 Counter
ACCESS read-only
STATUS mandatory
DESCRIPTION
"The number of times this neighbor relationship has changed state, or an error has occurred."
DEFVAL { 0 }
::= { ospfNbrEntry 7 }

ospfNbrLSRetransQLen OBJECT-TYPE
SYNTAX Gauge
ACCESS read-only
STATUS mandatory
DESCRIPTION
"The current length of the retransmission queue."
DEFVAL { 0 }
::= { ospfNbrEntry 8 }

ospfNBMANbrStatus OBJECT-TYPE
SYNTAX Validation
ACCESS read-write
STATUS mandatory
DESCRIPTION
"This variable displays the validity or invalidity of
the entry. Setting it to ‘invalid’ has the effect of rendering it inoperative. The internal effect (row removal) is implementation dependent.”

DEFVAL { valid }
::= { ospfNbrEntry 9 }

-- 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
ACCESS   not-accessible
STATUS   mandatory
DESCRIPTION
   "A table of virtual neighbor information."
REFERENCE
   "OSPF Version 2, Section 15 Virtual Links"
 ::= { ospf 11 }

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

OspfVirtNbrEntry ::=SEQUENCE {
 ospfVirtNbrArea
   AreaID,
 ospfVirtNbrRtrId
   RouterID,
 ospfVirtNbrIpAddr
   IpAddress,
 ospfVirtNbrOptions
   INTEGER,
 ospfVirtNbrState
   INTEGER,
 ospfVirtNbrEvents
   Counter,
 ospfVirtNbrLSRetransQLen
   Gauge
ospfVirtNbrArea OBJECT-TYPE
SYNTAX   AreaID
ACCESS   read-only
STATUS   mandatory
DESCRIPTION
   "The Transit Area Identifier."
 ::= { ospfVirtNbrEntry 1 }

ospfVirtNbrRtrId OBJECT-TYPE
SYNTAX   RouterID
ACCESS   read-only
STATUS   mandatory
DESCRIPTION
   "A 32-bit integer uniquely identifying the neighboring router in the Autonomous System."
 ::= { ospfVirtNbrEntry 2 }

ospfVirtNbrIpAddr OBJECT-TYPE
SYNTAX   IpAddress
ACCESS   read-only
STATUS   mandatory
DESCRIPTION
   "The IP address this Virtual Neighbor is using."
 ::= { ospfVirtNbrEntry 3 }

ospfVirtNbrOptions OBJECT-TYPE
SYNTAX   INTEGER
ACCESS   read-only
STATUS   mandatory
DESCRIPTION
   "A bit map corresponding to the neighbor’s options field. Thus, Bit 1, if set, indicates that the neighbor supports Type of Service Routing; if zero, no metrics other than TOS 0 are in use by the neighbor."
 ::= { ospfVirtNbrEntry 4 }

ospfVirtNbrState OBJECT-TYPE
SYNTAX   INTEGER {
   down (1),
   attempt (2),
   init (3),
   twoWay (4),
   exchangeStart (5),
   exchange (6),
   loading (7),
   full (8)
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7. References


8. Security Considerations

Security issues are not discussed in this memo.
9. Authors’ Addresses

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