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Softwire Mesh Management Information Base (MIB)
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Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular it defines objects for managing softwire mesh [RFC5565].

Status of This Memo

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1. Introduction

Softwire mesh framework RFC 5565 [RFC5565] is a tunneling mechanism which enables connectivity between islands of IPv4 networks across single IPv6 backbone and vice versa. In softwire mesh, extended multiprotocol-BGP (MP-BGP)is used to set up tunnels and advertise prefixes among address family border routers (AFBRs).

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular it defines objects for managing softwire mesh [RFC5565].

2. The Internet-Standard Management Framework

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

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

3. Terminology

This document uses terminology from softwire problem statement RFC 4925 [RFC4925] and softwire mesh framework RFC5565 [RFC5565].

4. Conventions

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

5. Structure of the MIB Module

The softwire mesh MIB provides a method to configure and manage the softwire mesh objects through SNMP.

5.1. The swmSupportedTunnlTable Subtree

Since AFBR need to negotiate with BGP peer what kind of tunnel they will use, it should firstly announce the types of tunnels it supports. The swmSupportedTunnlTable subtree provides the

information. According to section 4 of RFC 5512[RFC5512], current softwire mesh tunnel types include IP-IP, GRE and L2TPv3.

5.2. The swmEncapsTable Subtree

The swmEncapsTable subtree provides softwire mesh NLRI-NH information about the AFBR. It keeps the mapping between E-IP prefix and I-IP address of next hop. The mappings determine which I-IP destination address will be used to encapsulate the received packet's according to its E-IP destination address. The definitions of E-IP and I-IP are explained in section 4.1 of RFC 5565[RFC5565].

5.3. The swmBGPNeighborTable Subtree

The subtree provides softwire mesh BGP neighbor information of an AFBR. It includes the address of the softwire mesh BGP peer, and the kind of tunnel that the AFBR would use to communicate with this BGP peer.

5.4. The swmMIBConformance Subtree

The subtree provides conformance information of MIB objects.

6. Relationship to Other MIB Modules

6.1. Relationship to the IF-MIB

The Interfaces MIB [RFC2863] defines generic managed objects for managing interfaces. Each logical interface (physical or virtual) has an ifEntry. Tunnels are handled by creating logical interfaces (ifEntry). Being a tunnel, softwire mesh has an entry in the Interface MIB, as well as an entry in IP Tunnel MIB. Those corresponding entries are indexed by ifIndex.

The ifOperStatus in the ifTable would be used to represents whether the mesh function of the AFBR has been triggered. If the software mesh capability is negotiated during the BGP OPEN phase, the mesh function is considered to be started, and the ifOperStatus is "up". Otherwise the ifOperStatus is "down".

In the case of IPv4-over-IPv6 softwire mesh tunnel, the ifInUcastPkts counts the number of IPv6 packets which are sent to the virtual interface for decapsulation into IPv4. The ifOutUcastPkts counts the number of IPv6 packets which are generated by encapsulating IPv4 packets sent to the virtual interface. Particularly, if these IPv4 packets need fragmentation, ifOutUcastPkts counts the number of packets after fragmentation.

In the case of IPv6-over-IPv4 softwire mesh tunnel, the ifInUcastPkts counts the number of IPv4 packets, which are sent to the virtual interface for decapsulation into IPv6. The ifOutUcastPkts counts the number of IPv4 packets, which are generated by encapsulating IPv6 packets sent to the virtual interface. Particularly, if these IPv6 packets need to be fragmented, tifOutUcastPkts counts the number of packets after fragmentation. Similar definition apply to other counting objects in ifTable.

6.2. Relationship to the IP Tunnel MIB

The IP Tunnel MIB [RFC4087] contains objects applicable to all IP tunnels, including softwire mesh. On the other hand, Softwire Mesh MIB extends the IP tunnel MIB to further describe encapsulation-specific information.

Running a point to multi-point tunnel, it is necessary for a softwire mesh AFBR to maintain an encapsulation table, used to perform correct "forwarding" among AFBRs. This forwarding on an AFBR is performed by using the E-IP destination address to look up the I-IP encapsulation destination address in the encapsulation table. An AFBR also needs to know the BGP peer information of the other AFBRs, so that it can negotiate the NLRI-NH information and the tunnel parameters with them.

Softwire mesh requires the implmentation of the IP Tunnel MIB. The tunnelIfEncapsMethod in the tunnelIfEntry should be set to softwireMesh("xx"), and corresponding entry in the softwire mesh MIB module will exist for this tunnelIfEntry. The tunnelIfRemoteInetAddress must be set to 0.0.0.0 for IPv4 or :: for IPv6 because it is a point to multi-point tunnel.

The tunnelIfAddressType in tunnelIfTable represents the type of address in the corresponding tunnelIfLocalInetAddress and tunnelIfRemoteInetAddress objects. The tunnelIfAddressType is identical to swmEncapsIIPDstType in softwire mesh, which can support either IPv4-over-IPv6 or IPv6-over-IPv4. When swmEncapsEIPDstType is IPv6 and swmEncapsIIPDstType is IPv4, the mesh is IPv6-over-IPv4; When swmEncapsEIPDstType is IPv4 and swmEncapsIIPDstType is IPv6, the encapsulation would be IPv4-over-IPv6.

6.3. MIB modules required for IMPORTS

The following MIB module IMPORTS objects from SNMPv2-SMI [RFC2578], SNMPv2-CONF [RFC2580], IF-MIB [RFC2863] and INET-ADDRESS-MIB [RFC4001].

7. Definitions

```
SOFTWIRE-MESH-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE, transmission  FROM SNMPv2-SMI

    OBJECT-GROUP, MODULE-COMPLIANCE             FROM SNMPv2-CONF

    InetAddress, InetAddressType, InetAddressPrefixLength
FROM INET-ADDRESS-MIB

    ifIndex                                     FROM IF-MIB

    IANAtunnelType                              FROM IANAifType-MIB;

swmMIB MODULE-IDENTITY
    LAST-UPDATED "201303100000Z"        -- March 10, 2013
    ORGANIZATION "Softwire Working Group"
    CONTACT-INFO "

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                 Email comments directly to the softwire WG Mailing
                 List at softwires@ietf.org
    "

    DESCRIPTION
               "This MIB module contains managed object definitions for
                the softwire mesh framework."

    REVISION    "201303100000Z"
    DESCRIPTION
               "The MIB module is defined for management of object in
                the Softwire mesh framework."
    ::= { transmission 999 } --999 to be replaced with correct value

swmMIBObjects OBJECT IDENTIFIER ::= { swmMIB 1 }

-- swmSupportedTunnelTable
```

```
swmSupportedTunnelTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF SwmSupportedTunnelEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A table of objects that shows what kind of tunnels
        can be supported by the AFBR."
    ::= { swmMIBObjects 1 }

swmSupportedTunnelEntry  OBJECT-TYPE
    SYNTAX      SwmSupportedTunnelEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A set of objects that shows what kind of tunnels
        can be supported in the AFBR. If the AFBR supports
        multiple tunnel types, the swmSupportedTunnelTalbe
             would have several entries."
    INDEX { swmSupportedTunnelType }
    ::= { swmSupportedTunnelTable 1 }

SwmSupportedTunnelEntry ::= SEQUENCE {
    swmSupportedTunnelType              IANAtunnelType
}

swmSupportedTunnelType OBJECT-TYPE
    SYNTAX      IANAtunnelType
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Represents the tunnel type that the AFBR support. "
    ::= { swmSupportedTunnelEntry 1 }
-- end of swmSupportedTunnelTable

--swmEncapsTable
swmEncapsTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF SwmEncapsEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A table of objects that display and control the
        softwire mesh encapsulation information."
    ::= { swmMIBObjects 2 }

swmEncapsEntry  OBJECT-TYPE
    SYNTAX      SwmEncapsEntry
    MAX-ACCESS  not-accessible
    STATUS      current
```

```
    DESCRIPTION
        "A table of objects that manages the softwire mesh I-IP
         encapsulation destination based on the E-IP destination prefix."
    INDEX { ifIndex,
            swmEncapsEIPDstType,
            swmEncapsEIPDst,
            swmEncapsEIPMask
          }
    ::= { swmEncapsTable 1 }

SwmEncapsEntry ::=      SEQUENCE {
    swmEncapsEIPDstType      InetAddressType,
    swmEncapsEIPDst          InetAddress,
    swmEncapsEIPMask         InetAddressPrefixLength,
    swmEncapsIIPDstType      InetAddressType,
    swmEncapsIIPDst          InetAddress
}

swmEncapsEIPDstType OBJECT-TYPE
    SYNTAX      InetAddressType
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This object specifies the address type used for
         swmEncapsEIPDst."
    ::= { swmEncapsEntry 1 }

swmEncapsEIPDst OBJECT-TYPE
    SYNTAX      InetAddress
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The address of the destination prefix, which is
        used for I-IP encapsulation destination lookup
        based on longest prefix match. The address type is
        opposite to tunnelIfAddressType in tunnelIfTable."
    ::= { swmEncapsEntry 2 }

swmEncapsEIPMask OBJECT-TYPE
    SYNTAX      InetAddressPrefixLength
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The prefix length of E-IP address."
    ::= { swmEncapsEntry 3 }

swmEncapsIIPDstType OBJECT-TYPE
    SYNTAX      InetAddressType
```

```
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This object specifies the address type used for
         swmEncapsIIPDst."
    ::= { swmEncapsEntry 4 }

swmEncapsIIPDst OBJECT-TYPE
    SYNTAX      InetAddress
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The I-IP address as the encapsulated destination
         according to the E-IP address. The address type
        is the same as tunnelIfAddressType in tunnelIfTable.
        Since the tunnelIfRemoteInetAddress in tunnelIfTable
        should be 0.0.0.0 or ::, swmEncapIIPDst is the
        destination address used in the outer IP header."
    ::= { swmEncapsEntry 5 }
-- End of swmEncapsTable

-- swmBGPNeighborTable
swmBGPNeighborTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF SwmBGPNeighborEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A table of objects that displays the softwire mesh
        BGP neighbor information."
    ::= { swmMIBObjects 3 }

swmBGPNeighborEntry  OBJECT-TYPE
    SYNTAX      SwmBGPNeighborEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A set of objects that displays the softwire mesh
        BGP neighbor information."
    INDEX {
            ifIndex,
            swmBGPNeighborInetAddressType,
            swmBGPNeighborInetAddress
          }
    ::= { swmBGPNeighborTable 1 }

SwmBGPNeighborEntry ::= SEQUENCE {
        swmBGPNeighborInetAddressType    InetAddressType,
        swmBGPNeighborInetAddress        InetAddress,
```

```
        swmBGPNeighborTunnelType         IANAtunnelType
}

swmBGPNeighborInetAddressType OBJECT-TYPE
    SYNTAX      InetAddressType
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This object specifies the address type used for
         swmBGPNeighborInetAddress."
    ::= { swmBGPNeighborEntry 1 }

swmBGPNeighborInetAddress OBJECT-TYPE
    SYNTAX      InetAddress
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The address of the ABFR's BGP neighbor. The
        address type is the same as tunnelIfAddressType
        in tunnelIfTable"
    ::= { swmBGPNeighborEntry 2 }

swmBGPNeighborTunnelType OBJECT-TYPE
    SYNTAX      IANAtunnelType
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Represents the type of tunnel that the
        AFBR chooses to transmit traffic with another AFBR/BGP neighbor"
    ::= { swmBGPNeighborEntry 3 }
-- End of swmBGPNeighborTable

-- conformance information
swmMIBConformance
                    OBJECT IDENTIFIER ::= { swmMIB 2 }
swmMIBCompliances
                    OBJECT IDENTIFIER ::= { swmMIBConformance 1 }
swmMIBGroups
                    OBJECT IDENTIFIER ::= { swmMIBConformance 2 }

 -- compliance statements
swmMIBCompliance MODULE-COMPLIANCE
   STATUS current
   DESCRIPTION
       "Describes the requirements for conformance to the softwire
       mesh MIB.

       The following index objects cannot be added as OBJECT
```

```
       clauses but nevertheless have the compliance
       requirements:
       "
       -- OBJECT  swmEncapsEIPDstType
       -- SYNTAX  InetAddressType { ipv4(1), ipv6(2) }
       -- DESCRIPTION
       -- "An implementation is required to support
       --  global IPv4 and/or IPv6 addresses, depending
       --  on its support for IPv4 and IPv6."

       -- OBJECT  swmEncapsEIPDst
       -- SYNTAX  InetAddress (SIZE(4|16))
       -- DESCRIPTION
       -- "An implementation is required to support
       --  global IPv4 and/or IPv6 addresses, depending
       --  on its support for IPv4 and IPv6."

       -- OBJECT  swmEncapsEIPMask
       -- SYNTAX  InetAddressPrefixLength (ipv4(1),ipv4z(3),ipv6(2),ipv6z(2))
       -- DESCRIPTION
       -- "An implementation is required to support
       --  global IPv4 and/or IPv6 addresses, depending
       --  on its support for IPv4 and IPv6."

       -- OBJECT  swmBGPNeighborInetAddressType
       -- SYNTAX  InetAddressType { ipv4(1), ipv6(2) }
       -- DESCRIPTION
       -- "An implementation is required to support
       --  global IPv4 and/or IPv6 addresses, depending
       --  on its support for IPv4 and IPv6."

       -- OBJECT  swmBGPNeighborInetAddress
       -- SYNTAX  InetAddress (SIZE(4|16))
       -- DESCRIPTION
       -- "An implementation is required to support
       --  global IPv4 and/or IPv6 addresses, depending
       --  on its support for IPv4 and IPv6."

   MODULE -- this module
   MANDATORY-GROUPS    {
                         swmSupportedTunnelGroup,
                         swmEncapsGroup,
                         swmBGPNeighborGroup
                       }
   ::= { swmMIBCompliances 1 }

swmSupportedTunnelGroup    OBJECT-GROUP
   OBJECTS {
```

```
        swmSupportedTunnelType
    }
    STATUS  current
    DESCRIPTION
        "The collection of objects which are used to show
        what kind of tunnel the AFBR supports."
    ::= { swmMIBGroups 1 }

swmEncapsGroup    OBJECT-GROUP
    OBJECTS {
         swmEncapsIIPDstType,
         swmEncapsIIPDst
    }
    STATUS  current
    DESCRIPTION
        "The collection of objects which are used to display
        softwire mesh encapsulation information."
    ::= { swmMIBGroups 2 }

swmBGPNeighborGroup    OBJECT-GROUP
    OBJECTS {
         swmBGPNeighborTunnelType
    }
    STATUS  current
    DESCRIPTION
        "The collection of objects which are used to display
         softwire mesh BGP neighbor information."
    ::= { swmMIBGroups 3 }

END
```

8. Security Considerations

The swmMIB module can be used for configuration of certain objects, and anything that can be configured can be incorrectly configured, with potentially disastrous results. Because this MIB module reuses the IP tunnel MIB, the security considerations of the IP tunnel MIB is also applicable to the Softwire mesh MIB.

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPsec), even then, there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB module.

It is RECOMMENDED that implementers consider the security features as

provided by the SNMPv3 framework (see [RFC3410], section 8), including full support for the SNMPv3 cryptographic mechanisms (for authentication and privacy).

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator's responsibility to ensure that the SNMP entity giving access to an instance of this MIB module is properly configured to give access to the objects only to those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

9. IANA Considerations

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

Descriptor	OBJECT IDENTIFIER value
swmMIB	{ transmission XXX }

```
IANAtunnelType ::= TEXTUAL-CONVENTION
    SYNTAX     INTEGER {

                softwireMesh ("XX")        -- softwire Mesh tunnel

                }
```

10. Acknowledgements

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[ops] the IETF OPS Area, "http://www.ops.ietf.org".

[ietf] IETF Tools Team, "http://tools.ietf.org".

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