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**Software 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 software mesh [[RFC5565](#)].

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## **1. Introduction**

Softwire mesh framework [RFC 5565](#) [[RFC5565](#)] is a tunneling mechanism which enables connectivity between islands of IPv4, IPv6 or dual-stack networks across single IPv4 or IPv6 backbone networks. In softwire mesh solution, 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 software mesh tunnel types include IP-IP, GRE and L2TPv3.

### **5.2. The `swmEncapsTable` Subtree**

The `swmEncapsTable` subtree provides software mesh NLRI-NH information about the AFBR. It indicates which I-IP destination address will be encapsulated according to the arriving packet's 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 software mesh BGP neighbor information about the AFBR. It includes the address of software 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 a logical interface (`ifEntry`) for each tunnel. Software mesh tunnel also acts as a virtual interface, which has corresponding entries in IP Tunnel MIB and Interface MIB. Those corresponding entries are indexed by `ifIndex`.

The `ifOperStatus` in `ifTable` would be used to represent whether the mesh function of the AFBR has been started. During the BGP OPEN phase, if the software mesh capability is negotiated, the mesh function could be considered to be started, and `ifOperStatus` is "up". Otherwise the `ifOperStatus` is "down".

If it is IPv4-over-IPv6 software mesh tunnel, the `ifInUcastPkts` will represent the number of IPv6 packets which can be decapsulated to IPv4 in the virtual interface. The `ifOutUcastPkts` contains the number of IPv6 packets which have been encapsulated with IPv4 packets in it. Particularly, if these IPv4 packets need to be fragmented, the number counted here is the packets after fragmentation.



If it is IPv6-over-IPv4 software mesh tunnel, the ifInUcastPkts stands for the number of IPv4 packets which would be decapsulated to IPv6 in the virtual interface. The ifOutUcastPkts represents the number of IPv4 packets which have been encapsulated from IPv6. Particularly, if these IPv6 packets need to be fragmented, the number counted here is the 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 common to all IP tunnels, including software mesh. Additionally, tunnel encapsulation specific MIB (as is defined in this document) extends the IP tunnel MIB to further described encapsulation specific information.

Since software mesh is a point to multi-point tunnel, we need to specify an encapsulation table to support E-IP routing among AFBRs. With the encapsulation information, the correct forwarding of E-IP packets will be performed among AFBRs by using I-IP encapsulation. Each AFBR also needs to know information about remote BGP peers (AFBRs), so that these AFBRs can negotiate E-IP information and the tunnel types they support.

The implementation of the IP Tunnel MIB is required for software mesh. The tunnelIfEncapsMethod in the tunnelIfEntry should be set to softwareMesh("xx"), and corresponding entry in the software mesh MIB module will exist for every tunnelIfEntry with this tunnelIfEncapsMethod. The tunnelIfRemoteInetAddress must be set to 0.0.0.0 for IPv4 or :: for IPv6 because it is a point to multi-point tunnel.

Since tunnelIfAddressType in tunnelIfTable represents the type of address in the corresponding tunnelIfLocalInetAddress and tunnelIfRemoteInetAddress objects, we can also use the tunnelIfAddressType to specify the software mesh tunnel is IPv4-over-IPv6 or IPv6-over-IPv4. When tunnelIfAddressType is IPv4, the encapsulation would be IPv6-over-IPv4; When tunnelIfAddressType 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-TC [[RFC2579](#)], SNMPv2-CONF [[RFC2580](#)], IF-MIB [[RFC2863](#)] and INET-ADDRESS-MIB [[RFC4001](#)].

## **7. Definitions**

SOFTWARE-MESH-MIB DEFINITIONS ::= BEGIN





## IMPORTS

TruthValue, TEXTUAL-CONVENTION  
TimeStamp  
FROM SNMPv2-TC

OBJECT-GROUP, MODULE-COMPLIANCE  
FROM SNMPv2-CONF

MODULE-IDENTITY, OBJECT-TYPE, mib-2, Unsigned32, Counter32,  
Counter64  
FROM SNMPv2-SMI

IANA tunnelType FROM IANA ifType-MIB;

InetAddress, InetAddressPrefixLength  
FROM INET-ADDRESS-MIB

## swmMIB MODULE-IDENTITY

LAST-UPDATED "201207020000Z" -- July 02, 2012  
ORGANIZATION "Softwire Working Group"  
CONTACT-INFO "

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List at [softwires@ietf.org](mailto:softwires@ietf.org)

"

## DESCRIPTION

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

REVISION "201207020000Z"

## DESCRIPTION

"The MIB module is defined for management of object in  
the Softwire mesh framework."

::= {transmission xxx} --xxx to be replaced with correct value



```
-- 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 in the AFBR."
    ::= { swmMIB 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
        several kinds of tunnel type, the
        swmSupportedTunnelTable 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 kind of tunneling type that the AFBR
        support. "
    ::= { swmSupportedTunnelTypeEntry 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
        software mesh encapsulation information."
    ::= { swmMIB 2 }

swmEncapsEntry OBJECT-TYPE
```



SYNTAX        swmEncapsEntry  
MAX-ACCESS   not-accessible  
STATUS        current

## DESCRIPTION

"A set of objects that display and control the  
software mesh encapsulation information."

INDEX { ifIndex,  
          swmEncapsEIPDst,  
          swmEncapsEIPMask  
      }

::= { swmEncapsTable 1 }

swmEncapsEntry ::=

SEQUENCE {  
    swmEncapsEIPDst                InetAddress,  
    swmEncapsEIPMask              InetAddressPrefixLength,  
    swmEncapsIIPDst                InetAddress  
}

swmEncapsEIPDst OBJECT-TYPE

SYNTAX        InetAddress

MAX-ACCESS   read-only

STATUS        current

## DESCRIPTION

"The destination E-IP address that decide which  
I-IP address will be encapsulated. The address Type  
is opposite to tunnelIfAddressType in tunnelIfTable."

::= { swmEncapsEntry 1 }

swmEncapsEIPMask OBJECT-TYPE

SYNTAX        InetAddressPrefixLength

MAX-ACCESS   read-only

STATUS        current

## DESCRIPTION

"The prefix length of E-IP address."

::= { swmEncapsEntry 2 }

swmEncapsIIPDst OBJECT-TYPE

SYNTAX        InetAddress

MAX-ACCESS   read-only

STATUS        current

## DESCRIPTION

"The I-IP address that will be encapsulated  
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 3 }
-- End of swmEncapsTable

-- swmBGPNeighborTable
swmBGPNeighborTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF swmBGPNeighborEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A table of objects that display the software mesh
        BGP neighbor information."
    ::= { swmMIB 3 }

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

swmBGPNeighborEntry ::=
    SEQUENCE {
        swmBGPNeighborInetAddress      InetAddress,
        swmBGPNeighborTunnelType       IANATunnelType
    }

swmBGPNeighborInetAddress OBJECT-TYPE
    SYNTAX      InetAddress
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The address of the ABFR's BGP neighbor. The
        address type is the same as tunnelIfAddressType
        in tunnelIfTable"
    ::= { swmBGPNeighborEntry 1 }

swmBGPNeighborTunnelType OBJECT-TYPE
    SYNTAX      IANATunnelType
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Represents the kind of tunneling type that the
```





```
        AFBR used to communication with the BGP neighbor"
        ::= { swmBGPNeighborEntry 2 }
    -- End of swmBGPNeighborTable

-- conformance information
swmMIBConformance
    OBJECT IDENTIFIER ::= { swmMIB 4 }
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 software
        mesh MIB."

    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 {
        swmEncapsEIPDst,
        swmEncapsEIPMask,
        swmEncapsIIPDst
    }
    STATUS current
    DESCRIPTION
        "The collection of objects which are used to display
        software mesh encapsulation information."
    ::= { swmMIBGroups 2 }
```



```
swmBGPNeighborGroup    OBJECT-GROUP
  OBJECTS {
    swmBGPNeighborInetAddress,
    swmBGPNeighborTunnelType
  }
  STATUS current
  DESCRIPTION
    "The collection of objects which are used to display
    software 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 Software 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 }

IANA tunnelType ::= TEXTUAL-CONVENTION

SYNTAX INTEGER {

softwareMesh ("XX") -- software Mesh tunnel

}

## **10. Acknowledgements**

The authors would like to thank Dave Thaler, Jean-Philippe Dionne, Qi Sun, Sheng Jiang, Yu Fu for their valuable comments.

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- [xml2rfc] XML2RFC tools and documentation,  
"http://xml.resource.org".
- [ops] the IETF OPS Area, "http://www.ops.ietf.org".
- [ietf] IETF Tools Team, "http://tools.ietf.org".

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