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Y. Cui
J. Dong
P. Wu
M. Xu
Tsinghua University
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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). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIV2, which is described in STD 58, [RFC 2578](#) [[RFC2578](#)], STD 58, [RFC 2579](#) [[RFC2579](#)] and STD 58, [RFC 2580](#) [[RFC2580](#)].

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 way to configure and manage the softwire mesh objects through SNMP.

5.1. The swmSupportedTunnelTable Subtree

Since AFBR need to negotiate with BGP peer about what kind of tunnel they use, it should firstly announce what kind tunnels it supports. The swmSupportedTunnelTable subtree provides the information about what kind of tunnels the AFBR supports. According to section 4 of [RFC 5512](#), current software mesh tunnel supports IP-IP, GRE or L2TPv3.

5.2. The swmEncapsTable Subtree

The swmEncapsTable subtree provides software mesh NLRI-NH information about the AFBR. It indicates which E-IP destination address will be encapsulated according to the arriving packet's I-IP destination address.

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. It also includes what 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 in the Interfaces MIB [[RFC2863](#)]. 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", else the ifOperStatus is "down".

If it's IPv4-over-IPv6 software mesh tunnel, the ifInUcastPkts represents the number of IPv6 packets which would be decapsulated to IPv4 in the virtual interface. The ifOutUcastPkts represents the number of IPv6 packets which have been encapsulated from IPv4

packets. Particularly, if these IPv4 packets need to be fragmented, the number counted here is the packets after fragmentation.

If it's IPv6-over-IPv4 software mesh tunnel, the `ifInUcastPkts` represents 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 (like what is defined in this document) extend the IP tunnel MIB to further describe encapsulation specific information.

In case of software mesh, Since it's a point to multi-point tunnel, we need to specify a encapsulation table to support E-IP routing between AFBRs to achieve correct forwarding in E-IP networks and correct encapsulation on AFBRs. Each AFBR also needs to know information about remote BGP peers (AFBRs).

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's a point to multi-point tunnel.

Since `tunnelIfAddressType` in `tunnelIfTable` represents the type of address in the corresponding `tunnelIfLocalInetAddress` and `tunnelIfRemoteInetAddress` objects, we also can use the `tunnelIfAddressType` to specify the software mesh tunnel is IPv4-over-IPv6 or IPv6-over-IPv4 when the `tunnelIfEncapsMethod` is `softwareMesh`: 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

    IANAtunnelType          FROM IANAifType-MIB;

    InetAddress, InetAddressPrefixLength
        FROM INET-ADDRESS-MIB

swmMIB MODULE-IDENTITY
    LAST-UPDATED "201112290000Z"          -- December 29, 2011
    ORGANIZATION "Softwire Working Group"
    CONTACT-INFO "

        Yong Cui
        Email: yong@csnet1.cs.tsinghua.edu.cn

        Jiang Dong
        Email: dongjiang@csnet1.cs.tsinghua.edu.cn

        Peng Wu
        Email: weapon@csnet1.cs.tsinghua.edu.cn

        Mingwei Xu
        Email: xmw@cernet.edu.cn

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

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

REVISION    "201112290000Z"
DESCRIPTION
    "draft-03 version"
 ::= {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. Ef the AFBR supports
        several kinds of tunnel type, The
        swmSupportedTunnelTable would has sveral 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
        softwire 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,
        swmEncapsIIPDst,
        swmEncapsIIPMask
      }
```

```
::= { swmEncapsTable 1 }
```

```
swmEncapsEntry ::=
```

```
SEQUENCE {
    swmEncapsIIPDst      InetAddress,
    swmEncapsIIPMask    InetAddressPrefixLength,
    swmEncapsEIPDst     InetAddress
}
```

```
swmEncapsIIPDst OBJECT-TYPE
```

```
SYNTAX      InetAddress
```

```
MAX-ACCESS  read-only
```

```
STATUS      current
```

DESCRIPTION

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

```
::= { swmEncapsEntry 1 }
```

```
swmEncapsIIPMask OBJECT-TYPE
```

```
SYNTAX      InetAddressPrefixLength
```

```
MAX-ACCESS  read-only
```

```
STATUS      current
```

DESCRIPTION

"The prefix length of I-IP address."

```
::= { swmEncapsEntry 2 }
```

```
swmEncapsEIPDst OBJECT-TYPE
```

```
SYNTAX      InetAddress
```

```
MAX-ACCESS  read-only
```

```
STATUS      current
```

DESCRIPTION

"The E-IP address that will be encapsulated according to the I-IP address. The address Type is the same as tunnelIfAddressType in tunnelIfTable. Since the tunnelIfRemoteInetAddress in tunnelIfTable should be 0.0.0.0 or ::, swmEncapEIPDst 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 softwire 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 softwire 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 ABR'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 {
        swmEncapsIIPDst,
        swmEncapsIIPMask,
        swmEncapsEIPDst
    }
    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.

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

- o Unauthorized changes to the swmVIf4over6Table and swmVIf6over4Table may disrupt the configuration of the 4over6 mtu and 6over4 mtu of the virtual interface.

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 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 {

        softwareMesh ("XX")          -- software Mesh tunnel

    }

```

10. References

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[idnits] IETF Internet Drafts editor, "<http://www.ietf.org/ID-Checklist.html>".

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

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

Authors' Addresses

Yong Cui
Tsinghua University
Department of Computer Science, Tsinghua University
Beijing 100084
P.R.China

Phone: +86-10-6260-3059
EMail: yong@csnet1.cs.tsinghua.edu.cn

Jiang Dong
Tsinghua University
Department of Computer Science, Tsinghua University
Beijing 100084
P.R.China

Phone: +86-10-6278-5822
EMail: dongjiang@csnet1.cs.tsinghua.edu.cn

Peng Wu
Tsinghua University
Department of Computer Science, Tsinghua University
Beijing 100084
P.R.China

Phone: +86-10-6278-5822
EMail: weapon@csnet1.cs.tsinghua.edu.cn

Mingwei Xu
Tsinghua University
Department of Computer Science, Tsinghua University
Beijing 100084
P.R.China

Phone: +86-10-6278-5822
EMail: xmw@cernet.edu.cn

