

**ForCES****Internet Draft****Document:** [draft-haas-forces-mib-02.txt](#)

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## ForCES MIB

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## Abstract

This memo defines a Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it defines a MIB for the Forwarding and Control Element Separation (ForCES) Network Element (NE). The ForCES working group is defining a protocol to allow a Control Element (CE) to control the behavior of a Forwarding Element (FE).

## Conventions used in this document

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](#)].

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## [1. Introduction](#)

The ForCES MIB is a primarily read-only MIB that captures information related to the ForCES protocol. This includes state information about the associations between CE(s) and FE(s) in the NE.

The ForCES MIB does not include information that is specified in other MIBs, such as packet counters for interfaces, etc.

More specifically , the information in the ForCES MIB relative to associations includes:



- identifiers of the elements in the association
- state of the association
- configuration parameters of the association
- statistics of the association

The relevant references from the ForCES requirements and architecture documents are repeated below:

From the ForCES requirements RFC [\[RFC 3654\], Section 4](#), point 4:

A NE MUST support the appearance of a single functional device. For example, in a router, the TTL of the packet should be decremented only once as it traverses the NE regardless of how many FEs through which it passes. However, external entities (e.g., FE managers and CE managers) MAY have direct access to individual ForCES protocol elements for providing information to transition them from the pre-association to post-association phase.

And [\[RFC 3654\], Section 4](#), point 14:

1. The ability for a management tool (e.g., SNMP) to be used to read (but not change) the state of FE SHOULD NOT be precluded.
2. It MUST NOT be possible for management tools (e.g., SNMP, etc) to change the state of a FE in a manner that affects overall NE behavior without the CE being notified.

According to the ForCES architecture RFC [\[RFC 3746\], Section 3.3](#):

CE managers may be physically and logically separate entities that configure the CE with FE information via such mechanisms as COPS-PR [7] or SNMP [5].

and [\[RFC 3746\], Section 5.7](#):

[RFC 1812](#) [2] also dictates that "Routers MUST be manageable by SNMP". In general, for the post-association phase, most external management tasks (including SNMP) should be done through interaction with the CE in order to support the appearance of a single functional device. Therefore, it is recommended that an SNMP agent be implemented by CEs and that the SNMP messages received by FEs be redirected to their CEs. AgentX framework defined in [RFC 2741](#) ([6]) may be applied here such that CEs act in the role of master agent to process SNMP protocol messages while FEs act in the role of subagent to provide access to the MIB objects residing on FEs. AgentX protocol messages between the master agent (CE) and the subagent (FE) are encapsulated and transported via ForCES, just like data packets from any other application layer protocols.



## **2. Design of ForCES MIB**

In an NE composed of one or more FEs and a single CE, the CE is clearly aware of all associations and hence can provide this information in a single ForCES MIB. In contrast, in an NE composed of more than one CE, such association information is distributed and hence more than one ForCES MIB may be necessary, unless this information is aggregated into a single ForCES MIB by some means beyond the scope of this document. Nevertheless, the ForCES MIB design is compatible with both the single-CE and the multiple-CE case.

## **3. Association State**

Association state as shown in the MIB is considered from the CE's point of view:

- An association is in the DOWN state if the CE has not received any message (heartbeat or other protocol message) from the FE within a given time period or if an Association Teardown message has been sent by the CE.
- An association is in the ESTABLISHING state as long as no message has been received from the FE after the CE has sent a positive Association Setup Response message.
- An association is in the UP state in all other cases.

Note that it is left to the implementers to choose how long entries of associations in the DOWN state remain in the MIB until they are removed, if at all.

The ForCES protocol may be used by the CE to query the FE Protocol LFB about some of the configuration parameters. However, such queries may obviously be issued only when the association is in the UP state. Hence any MIB value that corresponds to such a parameter can only be considered valid as long as the association is in the UP state.

[Note: there is no such parameter in the MIB at this time]

[Note: Should the MIB indicate whether associations have been rejected ? Can this be a weakness exploited by DDoS if the MIB lists all such rejected associations ?]

## **4. ForCES MIB Definition**

For each association identified by the pair CE ID and FE ID, the following information is provided by the MIB:

- Current state of the association:



DOWN: the CE(s) indicated by the CE ID and FE(s) indicated by the FE ID are not associated.

ESTABLISHING: transient state until the association has been established. See [Section 3](#) above for details.

UP: the CE(s) indicated by the CE ID and FE(s) indicated by the FE ID are associated.

Association statistics:

- Time when the association attained the UP state.
- Time when the association appeared in the MIB.
- Number of transitions to ESTABLISHING state since the association appeared in the MIB.
- Number of transitions to UP state since the association appeared in the MIB.
- Number of ForCES messages sent/received since the association attained the UP state.

```
FORCES-MIB DEFINITIONS ::= BEGIN
```

```
IMPORTS
```

```
    OBJECT-TYPE, MODULE-IDENTITY,  
        Integer32, Counter32, Unsigned32  
    FROM SNMPv2-SMI
```

```
    TEXTUAL-CONVENTION, RowStatus, TimeInterval, TimeStamp  
    FROM SNMPv2-TC;
```

```
forcesMIB MODULE-IDENTITY
```

```
    LAST-UPDATED "200512071200Z" -- Dec 7, 2005
```

```
    ORGANIZATION "Forwarding and Control Element Separation  
                  (ForCES) Working Group"
```

```
    CONTACT-INFO
```

```
        "Robert Haas (rha@zurich.ibm.com), IBM"
```

```
    DESCRIPTION
```

```
        "Initial version, published as RFC yyyy. This MIB  
        contains managed object definitions for the ForCES  
        Protocol."
```

```
-- RFC Ed.: replace yyyy with actual RFC number & remove this note
```



```

 ::= { mib-2 XXX }
-- RFC Ed.: replace XXX with IANA-assigned number & remove this note

-- *****
ForcesID ::= TEXTUAL-CONVENTION
    STATUS      current
    DESCRIPTION
        "The ForCES identifier is a four octet quantity."
    SYNTAX      OCTET STRING (SIZE (4))

ForcesAssociationState ::= TEXTUAL-CONVENTION
    STATUS      current
    DESCRIPTION
        "The value down(1) indicates that the current state of
         the association is down. establishing(2) indicates
         that the association is in the process of being set
         up. up(3) indicates that the association is up."
    SYNTAX      INTEGER {
        down(1),
        establishing(2),
        up(3)
    }

forcesAssociations      OBJECT IDENTIFIER ::= { forcesMIB 1 }

forcesAssociationTable OBJECT-TYPE
    SYNTAX SEQUENCE OF ForcesAssociationEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "The (conceptual) table of associations."

    ::= { forcesAssociations 1 }

forcesAssociationEntry OBJECT-TYPE
    SYNTAX ForcesAssociationEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "A (conceptual) entry for one association."
    INDEX { forcesAssociationCEID, forcesAssociationFEID }
    ::= { forcesAssociationTable 1 }

ForcesAssociationEntry ::= SEQUENCE {
    forcesAssociationCEID      ForcesID,
    forcesAssociationFEID      ForcesID,

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forcesAssociationState	ForcesAssociationState,
forcesAssociationUptime	TimeStamp,
forcesAssociationCreated	TimeStamp,
forcesAssociationTransitionsEstablishing	Counter32,
forcesAssociationTransitionsUp	Counter32,
forcesAssociationMsgSent	Counter32,
forcesAssociationMsgReceived	Counter32

}

forcesAssociationCEID OBJECT-TYPE

SYNTAX ForcesID  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "The ForCES ID of the CE."  
 ::= { forcesAssociationEntry 1 }

forcesAssociationFEID OBJECT-TYPE

SYNTAX ForcesID  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "The ForCES ID of the FE."  
 ::= { forcesAssociationEntry 2 }

forcesAssociationState OBJECT-TYPE

SYNTAX ForcesAssociationState  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "The current operational state of the association  
    described by this row of the table."  
 ::= { forcesAssociationEntry 3 }

forcesAssociationUptime OBJECT-TYPE

SYNTAX TimeStamp  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "The time when this association came up."  
 ::= { forcesAssociationEntry 4 }

forcesAssociationCreated OBJECT-TYPE

SYNTAX TimeStamp  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "The time when this entry in the table was

created for this association."

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```
::= { forcesAssociationEntry 5 }
```

```
forcesAssociationTransitionsEstablishing OBJECT-TYPE
```

```
    SYNTAX Counter32
```

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

```
    STATUS current
```

```
    DESCRIPTION
```

```
        "A counter of how many times this association  
        state changed from down to establishing."
```

```
::= { forcesAssociationEntry 6}
```

```
forcesAssociationTransitionsUp OBJECT-TYPE
```

```
    SYNTAX Counter32
```

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

```
    STATUS current
```

```
    DESCRIPTION
```

```
        "A counter of how many times this association  
        state changed from establishing to up."
```

```
::= { forcesAssociationEntry 7}
```

```
forcesAssociationMsgSent OBJECT-TYPE
```

```
    SYNTAX Counter32
```

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

```
    STATUS current
```

```
    DESCRIPTION
```

```
        "A counter of how many messages have been sent on  
        this association since it is up."
```

```
::= { forcesAssociationEntry 8}
```

```
forcesAssociationMsgReceived OBJECT-TYPE
```

```
    SYNTAX Counter32
```

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

```
    STATUS current
```

```
    DESCRIPTION
```

```
        "A counter of how many messages have been received on  
        this association since it is up."
```

```
::= { forcesAssociationEntry 9}
```

```
END
```

## Security Considerations

Some of the readable objects in this MIB module may be considered sensitive or vulnerable in some network environment.

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.

## References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirements Levels", [BCP 14](#), [RFC 2119](#), March 1997.

[RFC3654] Khosravi, H., and Anderson, T., "Requirements for Separation of IP Control and Forwarding", [RFC 3654](#), November 2003.

[RFC3746] Yang, L., Dantu, R., Anderson, T., Gopal, R., "Forwarding and Control Element Separation (ForCES) Framework", [RFC 3746](#), April 2004.

[RFC3410] Case, J., Mundy, R., Partain, D., and B. Stewart, "Introduction and Applicability Statements for Internet- Standard Management Framework", [RFC 3410](#), December 2002.

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