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Simple Network Management Protocol (SNMP) Applications

Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

Abstract

This document describes five types of Simple Network Management Protocol (SNMP) applications which make use of an SNMP engine as described in STD 62, RFC 3411. The types of application described are Command Generators, Command Responders, Notification Originators, Notification Receivers, and Proxy Forwarders.

This document also defines Management Information Base (MIB) modules for specifying targets of management operations, for notification filtering, and for proxy forwarding. This document obsoletes RFC 2573.

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1. Overview

This document describes five types of SNMP applications:

- Applications which initiate SNMP Read-Class, and/or Write-Class requests, called 'command generators.'
- Applications which respond to SNMP Read-Class, and/or Write-Class requests, called 'command responders.'
- Applications which generate SNMP Notification-Class PDUs, called 'notification originators.'
- Applications which receive SNMP Notification-Class PDUs, called 'notification receivers.'
- Applications which forward SNMP messages, called 'proxy forwarders.'

Note that there are no restrictions on which types of applications may be associated with a particular SNMP engine. For example, a single SNMP engine may, in fact, be associated with both command generator and command responder applications.

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 [RFC2119].

1.1. Command Generator Applications

A command generator application initiates SNMP Read-Class and/or Write-Class requests, and processes responses to requests which it generated.

1.2. Command Responder Applications

A command responder application receives SNMP Read-Class and/or Write-Class requests destined for the local system as indicated by the fact that the contextEngineID in the received request is equal to that of the local engine through which the request was received. The command responder application will perform the appropriate protocol operation, using access control, and will generate a response message to be sent to the request's originator.

1.3. Notification Originator Applications

A notification originator application conceptually monitors a system for particular events or conditions, and generates Notification-Class messages based on these events or conditions. A notification originator must have a mechanism for determining where to send messages, and what SNMP version and security parameters to use when sending messages. A mechanism and MIB module for this purpose is provided in this document. Note that Notification-Class PDUs generated by a notification originator may be either Confirmed-Class or Unconfirmed-Class PDU types.

1.4. Notification Receiver Applications

A notification receiver application listens for notification messages, and generates response messages when a message containing a Confirmed-Class PDU is received.

1.5. Proxy Forwarder Applications

A proxy forwarder application forwards SNMP messages. Note that implementation of a proxy forwarder application is optional. The sections describing proxy (3.5, 4.3, and 7) may be skipped for implementations that do not include a proxy forwarder application.

The term "proxy" has historically been used very loosely, with multiple different meanings. These different meanings include (among others):

- (1) the forwarding of SNMP requests to other SNMP entities without regard for what managed object types are being accessed; for example, in order to forward an SNMP request from one transport domain to another, or to translate SNMP requests of one version into SNMP requests of another version;
- (2) the translation of SNMP requests into operations of some non-SNMP management protocol; and
- (3) support for aggregated managed objects where the value of one managed object instance depends upon the values of multiple other (remote) items of management information.

Each of these scenarios can be advantageous; for example, support for aggregation of management information can significantly reduce the bandwidth requirements of large-scale management activities.

However, using a single term to cover multiple different scenarios causes confusion.

To avoid such confusion, this document uses the term "proxy" with a much more tightly defined meaning. The term "proxy" is used in this document to refer to a proxy forwarder application which forwards either SNMP messages without regard for what managed objects are contained within those messages. This definition is most closely related to the first definition above. Note, however, that in the SNMP architecture [RFC3411], a proxy forwarder is actually an application, and need not be associated with what is traditionally thought of as an SNMP agent.

Specifically, the distinction between a traditional SNMP agent and a proxy forwarder application is simple:

- a proxy forwarder application forwards SNMP messages to other SNMP engines according to the context, and irrespective of the specific managed object types being accessed, and forwards the response to such previously forwarded messages back to the SNMP engine from which the original message was received;
- in contrast, the command responder application that is part of what is traditionally thought of as an SNMP agent, and which processes SNMP requests according to the (names of the) individual managed object types and instances being accessed, is NOT a proxy forwarder application from the perspective of this document.

Thus, when a proxy forwarder application forwards a request or notification for a particular contextEngineID / contextName pair, not only is the information on how to forward the request specifically associated with that context, but the proxy forwarder application has no need of a detailed definition of a MIB view (since the proxy forwarder application forwards the request irrespective of the managed object types).

In contrast, a command responder application must have the detailed definition of the MIB view, and even if it needs to issue requests to other entities, via SNMP or otherwise, that need is dependent on the individual managed object instances being accessed (i.e., not only on the context).

Note that it is a design goal of a proxy forwarder application to act as an intermediary between the endpoints of a transaction. In particular, when forwarding Confirmed Notification-Class messages, the associated response is forwarded when it is received from the target to which the Notification-Class message was forwarded, rather than generating a response immediately when the Notification-Class message is received.

2. Management Targets

Some types of applications (notification generators and proxy forwarders in particular) require a mechanism for determining where and how to send generated messages. This document provides a mechanism and MIB module for this purpose. The set of information that describes where and how to send a message is called a 'Management Target', and consists of two kinds of information:

- Destination information, consisting of a transport domain and a transport address. This is also termed a transport endpoint.
- SNMP parameters, consisting of message processing model, security model, security level, and security name information.

The SNMP-TARGET-MIB module described later in this document contains one table for each of these types of information. There can be a many-to-many relationship in the MIB between these two types of information. That is, there may be multiple transport endpoints associated with a particular set of SNMP parameters, or a particular transport endpoint may be associated with several sets of SNMP parameters.

3. Elements Of Procedure

The following sections describe the procedures followed by each type of application when generating messages for transmission or when processing received messages. Applications communicate with the Dispatcher using the abstract service interfaces defined in [RFC3411].

3.1. Command Generator Applications

A command generator initiates an SNMP request by calling the Dispatcher using the following abstract service interface:

```

statusInformation =          -- sendPduHandle if success
                             -- errorIndication if failure
    sendPdu(
    IN  transportDomain      -- transport domain to be used
    IN  transportAddress     -- destination network address
    IN  messageProcessingModel -- typically, SNMP version
    IN  securityModel       -- Security Model to use
    IN  securityName        -- on behalf of this principal
    IN  securityLevel       -- Level of Security requested
    IN  contextEngineID     -- data from/at this entity
    IN  contextName        -- data from/in this context
    IN  pduVersion          -- the version of the PDU
    IN  PDU                 -- SNMP Protocol Data Unit
    IN  expectResponse      -- TRUE or FALSE
    )

```

Where:

- The transportDomain is that of the destination of the message.
- The transportAddress is that of the destination of the message.
- The messageProcessingModel indicates which Message Processing Model the application wishes to use.
- The securityModel is the security model that the application wishes to use.

- The securityName is the security model independent name for the principal on whose behalf the application wishes the message to be generated.
- The securityLevel is the security level that the application wishes to use.
- The contextEngineID specifies the location of the management information it is requesting. Note that unless the request is being sent to a proxy, this value will usually be equal to the snmpEngineID value of the engine to which the request is being sent.
- The contextName specifies the local context name for the management information it is requesting.
- The pduVersion indicates the version of the PDU to be sent.
- The PDU is a value constructed by the command generator containing the management operation that the command generator wishes to perform.
- The expectResponse argument indicates that a response is expected.

The result of the sendPdu interface indicates whether the PDU was successfully sent. If it was successfully sent, the returned value will be a sendPduHandle. The command generator should store the sendPduHandle so that it can correlate a response to the original request.

The Dispatcher is responsible for delivering the response to a particular request to the correct command generator application. The abstract service interface used is:

```

processResponsePdu(           -- process Response PDU
    IN  messageProcessingModel -- typically, SNMP version
    IN  securityModel          -- Security Model in use
    IN  securityName           -- on behalf of this principal
    IN  securityLevel          -- Level of Security
    IN  contextEngineID        -- data from/at this SNMP entity
    IN  contextName            -- data from/in this context
    IN  pduVersion             -- the version of the PDU
    IN  PDU                    -- SNMP Protocol Data Unit
    IN  statusInformation      -- success or errorIndication
    IN  sendPduHandle          -- handle from sendPdu
)

```

Where:

- The messageProcessingModel is the value from the received response.
- The securityModel is the value from the received response.
- The securityName is the value from the received response.
- The securityLevel is the value from the received response.
- The contextEngineID is the value from the received response.
- The contextName is the value from the received response.
- The pduVersion indicates the version of the PDU in the received response.
- The PDU is the value from the received response.
- The statusInformation indicates success or failure in receiving the response.
- The sendPduHandle is the value returned by the sendPdu call which generated the original request to which this is a response.

The procedure when a command generator receives a message is as follows:

- (1) If the received values of messageProcessingModel, securityModel, securityName, contextEngineID, contextName, and pduVersion are not all equal to the values used in the original request, the response is discarded.
- (2) The operation type, request-id, error-status, error-index, and variable-bindings are extracted from the PDU and saved. If the request-id is not equal to the value used in the original request, the response is discarded.
- (3) At this point, it is up to the application to take an appropriate action. The specific action is implementation dependent. If the statusInformation indicates that the request failed, an appropriate action might be to attempt to transmit the request again, or to notify the person operating the application that a failure occurred.

3.2. Command Responder Applications

Before a command responder application can process messages, it must first associate itself with an SNMP engine. The abstract service interface used for this purpose is:

```
statusInformation =      -- success or errorIndication
registerContextEngineID(
  IN  contextEngineID    -- take responsibility for this one
  IN  pduType            -- the pduType(s) to be registered
)
```

Where:

- The statusInformation indicates success or failure of the registration attempt.
- The contextEngineID is equal to the snmpEngineID of the SNMP engine with which the command responder is registering.
- The pduType indicates a Read-Class and/or Write-Class PDU.

Note that if another command responder application is already registered with an SNMP engine, any further attempts to register with the same contextEngineID and pduType will be denied. This implies that separate command responder applications could register separately for the various pdu types. However, in practice this is undesirable, and only a single command responder application should be registered with an SNMP engine at any given time.

A command responder application can disassociate with an SNMP engine using the following abstract service interface:

```
unregisterContextEngineID(
  IN  contextEngineID    -- give up responsibility for this one
  IN  pduType            -- the pduType(s) to be unregistered
)
```

Where:

- The contextEngineID is equal to the snmpEngineID of the SNMP engine with which the command responder is cancelling the registration.
- The pduType indicates a Read-Class and/or Write-Class PDU.

Once the command responder has registered with the SNMP engine, it waits to receive SNMP messages. The abstract service interface used for receiving messages is:

```
processPdu(                -- process Request/Notification PDU
  IN  messageProcessingModel -- typically, SNMP version
  IN  securityModel          -- Security Model in use
  IN  securityName           -- on behalf of this principal
  IN  securityLevel          -- Level of Security
  IN  contextEngineID        -- data from/at this SNMP entity
  IN  contextName            -- data from/in this context
  IN  pduVersion             -- the version of the PDU
  IN  PDU                    -- SNMP Protocol Data Unit
  IN  maxSizeResponseScopedPDU -- maximum size of the Response PDU
  IN  stateReference         -- reference to state information
  )                          -- needed when sending a response
```

Where:

- The messageProcessingModel indicates which Message Processing Model received and processed the message.
- The securityModel is the value from the received message.
- The securityName is the value from the received message.
- The securityLevel is the value from the received message.
- The contextEngineID is the value from the received message.
- The contextName is the value from the received message.
- The pduVersion indicates the version of the PDU in the received message.
- The PDU is the value from the received message.
- The maxSizeResponseScopedPDU is the maximum allowable size of a ScopedPDU containing a Response PDU (based on the maximum message size that the originator of the message can accept).
- The stateReference is a value which references cached information about each received request message. This value must be returned to the Dispatcher in order to generate a response.

The procedure when a message is received is as follows:

- (1) The operation type is determined from the ASN.1 tag value associated with the PDU parameter. The operation type should always be one of the types previously registered by the application.
- (2) The request-id is extracted from the PDU and saved.
- (3) Any PDU type specific parameters are extracted from the PDU and saved (for example, if the PDU type is an SNMPv2 GetBulk PDU, the non-repeaters and max-repetitions values are extracted).
- (4) The variable-bindings are extracted from the PDU and saved.
- (5) The management operation represented by the PDU type is performed with respect to the relevant MIB view within the context named by the contextName (for an SNMPv2 PDU type, the operation is performed according to the procedures set forth in [RFC1905]). The relevant MIB view is determined by the securityLevel, securityModel, contextName, securityName, and the class of the PDU type. To determine whether a particular object instance is within the relevant MIB view, the following abstract service interface is called:

```

statusInformation =      -- success or errorIndication
  isAccessAllowed(
    IN  securityModel    -- Security Model in use
    IN  securityName     -- principal who wants to access
    IN  securityLevel    -- Level of Security
    IN  viewType         -- read, write, or notify view
    IN  contextName      -- context containing variableName
    IN  variableName     -- OID for the managed object
  )

```

Where:

- The securityModel is the value from the received message.
- The securityName is the value from the received message.
- The securityLevel is the value from the received message.
- The viewType indicates whether the PDU type is a Read-Class or Write-Class operation.
- The contextName is the value from the received message.

- The `variableName` is the object instance of the variable for which access rights are to be checked.

Normally, the result of the management operation will be a new PDU value, and processing will continue in step (6) below. However, at any time during the processing of the management operation:

- If the `isAccessAllowed` ASI returns a `noSuchView`, `noAccessEntry`, or `noGroupName` error, processing of the management operation is halted, a PDU value is constructed using the values from the originally received PDU, but replacing the error-status with an `authorizationError` code, and error-index value of 0, and control is passed to step (6) below.
 - If the `isAccessAllowed` ASI returns an `otherError`, processing of the management operation is halted, a different PDU value is constructed using the values from the originally received PDU, but replacing the error-status with a `genError` code and the error-index with the index of the failed variable binding, and control is passed to step (6) below.
 - If the `isAccessAllowed` ASI returns a `noSuchContext` error, processing of the management operation is halted, no result PDU is generated, the `snmpUnknownContexts` counter is incremented, and control is passed to step (6) below for generation of a report message.
 - If the context named by the `contextName` parameter is unavailable, processing of the management operation is halted, no result PDU is generated, the `snmpUnavailableContexts` counter is incremented, and control is passed to step (6) below for generation of a report message.
- (6) The Dispatcher is called to generate a response or report message. The abstract service interface is:

```
returnResponsePdu(  
  IN  messageProcessingModel  -- typically, SNMP version  
  IN  securityModel          -- Security Model in use  
  IN  securityName           -- on behalf of this principal  
  IN  securityLevel          -- same as on incoming request  
  IN  contextEngineID        -- data from/at this SNMP entity  
  IN  contextName            -- data from/in this context  
  IN  pduVersion             -- the version of the PDU  
  IN  PDU                    -- SNMP Protocol Data Unit  
  IN  maxSizeResponseScopedPDU -- maximum size of the Response PDU  
  IN  stateReference         -- reference to state information  
                                -- as presented with the request  
  IN  statusInformation      -- success or errorIndication  
  )                          -- error counter OID/value if error
```

Where:

- The messageProcessingModel is the value from the processPdu call.
- The securityModel is the value from the processPdu call.
- The securityName is the value from the processPdu call.
- The securityLevel is the value from the processPdu call.
- The contextEngineID is the value from the processPdu call.
- The contextName is the value from the processPdu call.
- The pduVersion indicates the version of the PDU to be returned. If no result PDU was generated, the pduVersion is an undefined value.
- The PDU is the result generated in step (5) above. If no result PDU was generated, the PDU is an undefined value.
- The maxSizeResponseScopedPDU is a local value indicating the maximum size of a ScopedPDU that the application can accept.
- The stateReference is the value from the processPdu call.
- The statusInformation either contains an indication that no error occurred and that a response should be generated, or contains an indication that an error occurred along with the OID and counter value of the appropriate error counter object.

Note that a command responder application should always call the `returnResponsePdu` abstract service interface, even in the event of an error such as a resource allocation error. In the event of such an error, the PDU value passed to `returnResponsePdu` should contain appropriate values for `errorStatus` and `errorIndex`.

Note that the text above describes situations where the `snmpUnknownContexts` counter is incremented, and where the `snmpUnavailableContexts` counter is incremented. The difference between these is that the `snmpUnknownContexts` counter is incremented when a request is received for a context which is unknown to the SNMP entity. The `snmpUnavailableContexts` counter is incremented when a request is received for a context which is known to the SNMP entity, but is currently unavailable. Determining when a context is unavailable is implementation specific, and some implementations may never encounter this situation, and so may never increment the `snmpUnavailableContexts` counter.

3.3. Notification Originator Applications

A notification originator application generates SNMP messages containing Notification-Class PDUs (for example, SNMPv2-Trap PDUs or Inform PDUs). There is no requirement as to what specific types of Notification-Class PDUs a particular implementation must be capable of generating.

Notification originator applications require a mechanism for identifying the management targets to which notifications should be sent. The particular mechanism used is implementation dependent. However, if an implementation makes the configuration of management targets SNMP manageable, it MUST use the `SNMP-TARGET-MIB` module described in this document.

When a notification originator wishes to generate a notification, it must first determine in which context the information to be conveyed in the notification exists, i.e., it must determine the `contextEngineID` and `contextName`. It must then determine the set of management targets to which the notification should be sent. The application must also determine, for each management target, what specific PDU type the notification message should contain, and if it is to contain a Confirmed-Class PDU, the number of retries and retransmission algorithm.

The mechanism by which a notification originator determines this information is implementation dependent. Once the application has determined this information, the following procedure is performed for each management target:

- (1) Any appropriate filtering mechanisms are applied to determine whether the notification should be sent to the management target. If such filtering mechanisms determine that the notification should not be sent, processing continues with the next management target. Otherwise,
- (2) The appropriate set of variable-bindings is retrieved from local MIB instrumentation within the relevant MIB view. The relevant MIB view is determined by the securityLevel, securityModel, contextName, and securityName of the management target. To determine whether a particular object instance is within the relevant MIB view, the isAccessAllowed abstract service interface is used, in the same manner as described in the preceding section, except that the viewType indicates a Notification-Class operation. If the statusInformation returned by isAccessAllowed does not indicate accessAllowed, the notification is not sent to the management target.
- (3) The NOTIFICATION-TYPE OBJECT IDENTIFIER of the notification (this is the value of the element of the variable bindings whose name is snmpTrapOID.0, i.e., the second variable binding) is checked using the isAccessAllowed abstract service interface, using the same parameters used in the preceding step. If the statusInformation returned by isAccessAllowed does not indicate accessAllowed, the notification is not sent to the management target.
- (4) A PDU is constructed using a locally unique request-id value, a PDU type as determined by the implementation, an error-status and error-index value of 0, and the variable-bindings supplied previously in step (2).
- (5) If the notification contains an Unconfirmed-Class PDU, the Dispatcher is called using the following abstract service interface:

```
statusInformation =          -- sendPduHandle if success
                             -- errorIndication if failure
    sendPdu(
    IN  transportDomain      -- transport domain to be used
    IN  transportAddress     -- destination network address
    IN  messageProcessingModel -- typically, SNMP version
    IN  securityModel        -- Security Model to use
    IN  securityName         -- on behalf of this principal
    IN  securityLevel        -- Level of Security requested
    IN  contextEngineID      -- data from/at this entity
    IN  contextName          -- data from/in this context
    IN  pduVersion           -- the version of the PDU
    IN  PDU                  -- SNMP Protocol Data Unit
    IN  expectResponse       -- TRUE or FALSE
    )
```

Where:

- The transportDomain is that of the management target.
- The transportAddress is that of the management target.
- The messageProcessingModel is that of the management target.
- The securityModel is that of the management target.
- The securityName is that of the management target.
- The securityLevel is that of the management target.
- The contextEngineID is the value originally determined for the notification.
- The contextName is the value originally determined for the notification.
- The pduVersion is the version of the PDU to be sent.
- The PDU is the value constructed in step (4) above.
- The expectResponse argument indicates that no response is expected.

Otherwise,

- (6) If the notification contains a Confirmed-Class PDU, then:
- a) The Dispatcher is called using the sendPdu abstract service interface as described in step (5) above, except that the expectResponse argument indicates that a response is expected.
 - b) The application caches information about the management target.
 - c) If a response is received within an appropriate time interval from the transport endpoint of the management target, the notification is considered acknowledged and the cached information is deleted. Otherwise,
 - d) If a response is not received within an appropriate time period, or if a report indication is received, information about the management target is retrieved from the cache, and steps a) through d) are repeated. The number of times these steps are repeated is equal to the previously determined retry count. If this retry count is exceeded, the acknowledgement of the notification is considered to have failed, and processing of the notification for this management target is halted. Note that some report indications might be considered a failure. Such report indications should be interpreted to mean that the acknowledgement of the notification has failed, and that steps a) through d) need not be repeated.

Responses to Confirmed-Class PDU notifications will be received via the processResponsePdu abstract service interface.

To summarize, the steps that a notification originator follows when determining where to send a notification are:

- Determine the targets to which the notification should be sent.
- Apply any required filtering to the list of targets.
- Determine which targets are authorized to receive the notification.

3.4. Notification Receiver Applications

Notification receiver applications receive SNMP Notification messages from the Dispatcher. Before any messages can be received, the notification receiver must register with the Dispatcher using the registerContextEngineID abstract service interface. The parameters used are:

- The contextEngineID is an undefined 'wildcard' value. Notifications are delivered to a registered notification receiver regardless of the contextEngineID contained in the notification message.
- The pduType indicates the type of notifications that the application wishes to receive (for example, SNMPv2-Trap PDUs or Inform PDUs).

Once the notification receiver has registered with the Dispatcher, messages are received using the processPdu abstract service interface. Parameters are:

- The messageProcessingModel indicates which Message Processing Model received and processed the message.
- The securityModel is the value from the received message.
- The securityName is the value from the received message.
- The securityLevel is the value from the received message.
- The contextEngineID is the value from the received message.
- The contextName is the value from the received message.
- The pduVersion indicates the version of the PDU in the received message.
- The PDU is the value from the received message.
- The maxSizeResponseScopedPDU is the maximum allowable size of a ScopedPDU containing a Response PDU (based on the maximum message size that the originator of the message can accept).
- If the message contains an Unconfirmed-Class PDU, the stateReference is undefined and unused. Otherwise, the stateReference is a value which references cached information about the notification. This value must be returned to the Dispatcher in order to generate a response.

When an Unconfirmed-Class PDU is delivered to a notification receiver application, it first extracts the SNMP operation type, request-id, error-status, error-index, and variable-bindings from the PDU. After this, processing depends on the particular implementation.

When a Confirmed-Class PDU is received, the notification receiver application follows the following procedure:

- (1) The PDU type, request-id, error-status, error-index, and variable-bindings are extracted from the PDU.
- (2) A Response-Class PDU is constructed using the extracted request-id and variable-bindings, and with error-status and error-index both set to 0.
- (3) The Dispatcher is called to generate a response message using the returnResponsePdu abstract service interface. Parameters are:
 - The messageProcessingModel is the value from the processPdu call.
 - The securityModel is the value from the processPdu call.
 - The securityName is the value from the processPdu call.
 - The securityLevel is the value from the processPdu call.
 - The contextEngineID is the value from the processPdu call.
 - The contextName is the value from the processPdu call.
 - The pduVersion indicates the version of the PDU to be returned.
 - The PDU is the result generated in step (2) above.
 - The maxSizeResponseScopedPDU is a local value indicating the maximum size of a ScopedPDU that the application can accept.
 - The stateReference is the value from the processPdu call.
 - The statusInformation indicates that no error occurred and that a response should be generated.
- (4) After this, processing depends on the particular implementation.

3.5. Proxy Forwarder Applications

A proxy forwarder application deals with forwarding SNMP messages. There are four basic types of messages which a proxy forwarder application may need to forward. These are grouped according to the class of PDU type contained in a message. The four basic types of messages are:

- Those containing Read-Class or Write-Class PDU types (for example, Get, GetNext, GetBulk, and Set PDU types). These deal with requesting or modifying information located within a particular context.
- Those containing Notification-Class PDU types (for example, SNMPv2-Trap and Inform PDU types). These deal with notifications concerning information located within a particular context.
- Those containing a Response-Class PDU type. Forwarding of Response-Class PDUs always occurs as a result of receiving a response to a previously forwarded message.
- Those containing Internal-Class PDU types (for example, a Report PDU). Forwarding of Internal-Class PDU types always occurs as a result of receiving an Internal-Class PDU in response to a previously forwarded message.

For the first type, the proxy forwarder's role is to deliver a request for management information to an SNMP engine which is "closer" or "downstream in the path" to the SNMP engine which has access to that information, and to deliver the response containing the information back to the SNMP engine from which the request was received. The context information in a request is used to determine which SNMP engine has access to the requested information, and this is used to determine where and how to forward the request.

For the second type, the proxy forwarder's role is to determine which SNMP engines should receive notifications about management information from a particular location. The context information in a notification message determines the location to which the information contained in the notification applies. This is used to determine which SNMP engines should receive notification about this information.

For the third type, the proxy forwarder's role is to determine which previously forwarded request or notification (if any) the response matches, and to forward the response back to the initiator of the request or notification.

For the fourth type, the proxy forwarder's role is to determine which previously forwarded request or notification (if any) the Internal-Class PDU matches, and to forward the Internal-Class PDU back to the initiator of the request or notification.

When forwarding messages, a proxy forwarder application must perform a translation of incoming management target information into outgoing management target information. How this translation is performed is implementation specific. In many cases, this will be driven by a preconfigured translation table. If a proxy forwarder application makes the contents of this table SNMP manageable, it MUST use the SNMP-PROXY-MIB module defined in this document.

3.5.1. Request Forwarding

There are two phases for request forwarding. First, the incoming request needs to be passed through the proxy application. Then, the resulting response needs to be passed back. These phases are described in the following two sections.

3.5.1.1. Processing an Incoming Request

A proxy forwarder application that wishes to forward request messages must first register with the Dispatcher using the registerContextEngineID abstract service interface. The proxy forwarder must register each contextEngineID for which it wishes to forward messages, as well as for each pduType. Note that as the configuration of a proxy forwarder is changed, the particular contextEngineID values for which it is forwarding may change. The proxy forwarder should call the registerContextEngineID and unregisterContextEngineID abstract service interfaces as needed to reflect its current configuration.

A proxy forwarder application should never attempt to register a value of contextEngineID which is equal to the snmpEngineID of the SNMP engine to which the proxy forwarder is associated.

Once the proxy forwarder has registered for the appropriate contextEngineID values, it can start processing messages. The following procedure is used:

- (1) A message is received using the processPdu abstract service interface. The incoming management target information received from the processPdu interface is translated into outgoing management target information. Note that this translation may vary for different values of contextEngineID and/or contextName. The translation should result in a single management target.
- (2) If appropriate outgoing management target information cannot be found, the proxy forwarder increments the snmpProxyDrops counter [RFC1907], and then calls the Dispatcher using the returnResponsePdu abstract service interface. Parameters are:

- The messageProcessingModel is the value from the processPdu call.
- The securityModel is the value from the processPdu call.
- The securityName is the value from the processPdu call.
- The securityLevel is the value from the processPdu call.
- The contextEngineID is the value from the processPdu call.
- The contextName is the value from the processPdu call.
- The pduVersion is the value from the processPdu call.
- The PDU is an undefined value.
- The maxSizeResponseScopedPDU is a local value indicating the maximum size of a ScopedPDU that the application can accept.
- The stateReference is the value from the processPdu call.
- The statusInformation indicates that an error occurred and includes the OID and value of the snmpProxyDrops object.

Processing of the message stops at this point. Otherwise,

- (3) A new PDU is constructed. A unique value of request-id should be used in the new PDU (this value will enable a subsequent response message to be correlated with this request). The remainder of the new PDU is identical to the received PDU, unless the incoming SNMP version and the outgoing SNMP version support different PDU versions, in which case the proxy forwarder may need to perform a translation on the PDU. (A method for performing such a translation is described in [RFC2576].)
- (4) The proxy forwarder calls the Dispatcher to generate the forwarded message, using the sendPdu abstract service interface. The parameters are:
 - The transportDomain is that of the outgoing management target.
 - The transportAddress is that of the outgoing management target.
 - The messageProcessingModel is that of the outgoing management target.
 - The securityModel is that of the outgoing management target.

- The securityName is that of the outgoing management target.
 - The securityLevel is that of the outgoing management target.
 - The contextEngineID is the value from the processPdu call.
 - The contextName is the value from the processPdu call.
 - The pduVersion is the version of the PDU to be sent.
 - The PDU is the value constructed in step (3) above.
 - The expectResponse argument indicates that a response is expected. If the sendPdu call is unsuccessful, the proxy forwarder performs the steps described in (2) above. Otherwise:
- (5) The proxy forwarder caches the following information in order to match an incoming response to the forwarded request:
- The sendPduHandle returned from the call to sendPdu,
 - The request-id from the received PDU.
 - The contextEngineID,
 - The contextName,
 - The stateReference,
 - The incoming management target information,
 - The outgoing management information,
 - Any other information needed to match an incoming response to the forwarded request.

If this information cannot be cached (possibly due to a lack of resources), the proxy forwarder performs the steps described in (2) above. Otherwise:

- (6) Processing of the request stops until a response to the forwarded request is received, or until an appropriate time interval has expired. If this time interval expires before a response has been received, the cached information about this request is removed.

3.5.1.2. Processing an Incoming Response

A proxy forwarder follows the following procedure when an incoming response is received:

- (1) The incoming response is received using the `processResponsePdu` interface. The proxy forwarder uses the received parameters to locate an entry in its cache of pending forwarded requests. This is done by matching the received parameters with the cached values of `sendPduHandle`, `contextEngineID`, `contextName`, outgoing management target information, and the request-id contained in the received PDU (the proxy forwarder must extract the request-id for this purpose). If an appropriate cache entry cannot be found, processing of the response is halted. Otherwise:
- (2) The cache information is extracted, and removed from the cache.
- (3) A new Response-Class PDU is constructed, using the request-id value from the original forwarded request (as extracted from the cache). All other values are identical to those in the received Response-Class PDU, unless the incoming SNMP version and the outgoing SNMP version support different PDU versions, in which case the proxy forwarder may need to perform a translation on the PDU. (A method for performing such a translation is described in [RFC2576].)
- (4) The proxy forwarder calls the Dispatcher using the `returnResponsePdu` abstract service interface. Parameters are:
 - The `messageProcessingModel` indicates the Message Processing Model by which the original incoming message was processed.
 - The `securityModel` is that of the original incoming management target extracted from the cache.
 - The `securityName` is that of the original incoming management target extracted from the cache.
 - The `securityLevel` is that of the original incoming management target extracted from the cache.
 - The `contextEngineID` is the value extracted from the cache.
 - The `contextName` is the value extracted from the cache.
 - The `pduVersion` indicates the version of the PDU to be returned.
 - The PDU is the (possibly translated) Response PDU.

- The `maxSizeResponseScopedPDU` is a local value indicating the maximum size of a `ScopedPDU` that the application can accept.
- The `stateReference` is the value extracted from the cache.
- The `statusInformation` indicates that no error occurred and that a `Response PDU` message should be generated.

3.5.1.3. Processing an Incoming Internal-Class PDU

A proxy forwarder follows the following procedure when an incoming Internal-Class PDU is received:

- (1) The incoming Internal-Class PDU is received using the `processResponsePdu` interface. The proxy forwarder uses the received parameters to locate an entry in its cache of pending forwarded requests. This is done by matching the received parameters with the cached values of `sendPduHandle`. If an appropriate cache entry cannot be found, processing of the Internal-Class PDU is halted. Otherwise:
 - (2) The cache information is extracted, and removed from the cache.
 - (3) If the original incoming management target information indicates an SNMP version which does not support Report PDUs, processing of the Internal-Class PDU is halted.
 - (4) The proxy forwarder calls the Dispatcher using the `returnResponsePdu` abstract service interface. Parameters are:
 - The `messageProcessingModel` indicates the Message Processing Model by which the original incoming message was processed.
 - The `securityModel` is that of the original incoming management target extracted from the cache.
 - The `securityName` is that of the original incoming management target extracted from the cache.
 - The `securityLevel` is that of the original incoming management target extracted from the cache.
 - The `contextEngineID` is the value extracted from the cache.
 - The `contextName` is the value extracted from the cache.
 - The `pduVersion` indicates the version of the PDU to be returned.

- The PDU is unused.
- The maxSizeResponseScopedPDU is a local value indicating the maximum size of a ScopedPDU that the application can accept.
- The stateReference is the value extracted from the cache.
- The statusInformation contains values specific to the Internal-Class PDU type (for example, for a Report PDU, the statusInformation contains the contextEngineID, contextName, counter OID, and counter value received in the incoming Report PDU).

3.5.2. Notification Forwarding

A proxy forwarder receives notifications in the same manner as a notification receiver application, using the processPdu abstract service interface. The following procedure is used when a notification is received:

- (1) The incoming management target information received from the processPdu interface is translated into outgoing management target information. Note that this translation may vary for different values of contextEngineID and/or contextName. The translation may result in multiple management targets.
- (2) If appropriate outgoing management target information cannot be found and the notification was an Unconfirmed-Class PDU, processing of the notification is halted. If appropriate outgoing management target information cannot be found and the notification was a Confirmed-Class PDU, the proxy forwarder increments the snmpProxyDrops object, and calls the Dispatcher using the returnResponsePdu abstract service interface. The parameters are:
 - The messageProcessingModel is the value from the processPdu call.
 - The securityModel is the value from the processPdu call.
 - The securityName is the value from the processPdu call.
 - The securityLevel is the value from the processPdu call.
 - The contextEngineID is the value from the processPdu call.
 - The contextName is the value from the processPdu call.

- The pduVersion is the value from the processPdu call.
- The PDU is an undefined and unused value.
- The maxSizeResponseScopedPDU is a local value indicating the maximum size of a ScopedPDU that the application can accept.
- The stateReference is the value from the processPdu call.
- The statusInformation indicates that an error occurred and that a Report message should be generated.

Processing of the message stops at this point. Otherwise,

(3) The proxy forwarder generates a notification using the procedures described in the preceding section on Notification Originators, with the following exceptions:

- The contextEngineID and contextName values from the original received notification are used.
- The outgoing management targets previously determined are used.
- No filtering mechanisms are applied.
- The variable-bindings from the original received notification are used, rather than retrieving variable-bindings from local MIB instrumentation. In particular, no access-control is applied to these variable-bindings, nor to the value of the variable-binding containing snmpTrapOID.0.
- If the original notification contains a Confirmed-Class PDU, then any outgoing management targets for which the outgoing SNMP version does not support any PDU types that are both Notification-Class and Confirmed-Class PDUs will not be used when generating the forwarded notifications.
- If, for any of the outgoing management targets, the incoming SNMP version and the outgoing SNMP version support different PDU versions, the proxy forwarder may need to perform a translation on the PDU. (A method for performing such a translation is described in [RFC2576].)

(4) If the original received notification contains an Unconfirmed-Class PDU, processing of the notification is now completed. Otherwise, the original received notification must contain Confirmed-Class PDU, and processing continues.

- (5) If the forwarded notifications included any Confirmed-Class PDUs, processing continues when the procedures described in the section for Notification Originators determine that either:
- None of the generated notifications containing Confirmed-Class PDUs have been successfully acknowledged within the longest of the time intervals, in which case processing of the original notification is halted, or,
 - At least one of the generated notifications containing Confirmed-Class PDUs is successfully acknowledged, in which case a response to the original received notification containing an Confirmed-Class PDU is generated as described in the following steps.
- (6) A Response-Class PDU is constructed, using the values of request-id and variable-bindings from the original received Notification-Class PDU, and error-status and error-index values of 0.
- (7) The Dispatcher is called using the returnResponsePdu abstract service interface. Parameters are:
- The messageProcessingModel is the value from the processPdu call.
 - The securityModel is the value from the processPdu call.
 - The securityName is the value from the processPdu call.
 - The securityLevel is the value from the processPdu call.
 - The contextEngineID is the value from the processPdu call.
 - The contextName is the value from the processPdu call.
 - The pduVersion indicates the version of the PDU constructed in step (6) above.
 - The PDU is the value constructed in step (6) above.
 - The maxSizeResponseScopedPDU is a local value indicating the maximum size of a ScopedPDU that the application can accept.
 - The stateReference is the value from the processPdu call.
 - The statusInformation indicates that no error occurred and that a Response-Class PDU message should be generated.

4. The Structure of the MIB Modules

There are three separate MIB modules described in this document, the management target MIB, the notification MIB, and the proxy MIB. The following sections describe the structure of these three MIB modules.

The use of these MIBs by particular types of applications is described later in this document:

- The use of the management target MIB and the notification MIB in notification originator applications is described in section 5.
- The use of the notification MIB for filtering notifications in notification originator applications is described in section 6.
- The use of the management target MIB and the proxy MIB in proxy forwarding applications is described in section 7.

4.1. The Management Target MIB Module

The SNMP-TARGET-MIB module contains objects for defining management targets. It consists of two tables and conformance/compliance statements.

The first table, the `snmpTargetAddrTable`, contains information about transport domains and addresses. It also contains an object, `snmpTargetAddrTagList`, which provides a mechanism for grouping entries.

The second table, the `snmpTargetParamsTable`, contains information about SNMP version and security information to be used when sending messages to particular transport domains and addresses.

The Management Target MIB is intended to provide a general-purpose mechanism for specifying transport address, and for specifying parameters of SNMP messages generated by an SNMP entity. It is used within this document for generation of notifications and for proxy forwarding. However, it may be used for other purposes. If another document makes use of this MIB, that document is responsible for specifying how it is used. For example, [RFC2576] uses this MIB for source address validation of SNMPv1 messages.

4.1.1. Tag Lists

The `snmpTargetAddrTagList` object is used for grouping entries in the `snmpTargetAddrTable`. The value of this object contains a list of tag values which are used to select target addresses to be used for a particular operation.

A tag value, which may also be used in MIB objects other than `snmpTargetAddrTagList`, is an arbitrary string of octets, but may not contain a delimiter character. Delimiter characters are defined to be one of the following characters:

- An ASCII space character (0x20).
- An ASCII TAB character (0x09).
- An ASCII carriage return (CR) character (0x0D).
- An ASCII line feed (LF) character (0x0A).

In addition, a tag value within a tag list may not have a zero length. Generally, a particular MIB object may contain either

- a zero-length octet string representing an empty list, or
- a single tag value, in which case the value of the MIB object may not contain a delimiter character, or
- a list of tag values, separated by single delimiter characters.

For a list of tag values, these constraints imply certain restrictions on the value of a MIB object:

- There cannot be a leading or trailing delimiter character.
- There cannot be multiple adjacent delimiter characters.

4.1.2. Definitions

```
SNMP-TARGET-MIB DEFINITIONS ::= BEGIN
```

```
IMPORTS
```

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

```
    TEXTUAL-CONVENTION,  
    TDomain,  
    TAddress,  
    TimeInterval,  
    RowStatus,  
    StorageType,
```

TestAndIncr
FROM SNMPv2-TC

SnmpSecurityModel,
SnmpMessageProcessingModel,
SnmpSecurityLevel,
SnmpAdminString
FROM SNMP-FRAMEWORK-MIB

MODULE-COMPLIANCE,
OBJECT-GROUP
FROM SNMPv2-CONF;

snmpTargetMIB MODULE-IDENTITY
LAST-UPDATED "200210140000Z"
ORGANIZATION "IETF SNMPv3 Working Group"
CONTACT-INFO
"WG-email: snmpv3@lists.tislabs.com
Subscribe: majordomo@lists.tislabs.com
In message body: subscribe snmpv3

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DESCRIPTION

"This MIB module defines MIB objects which provide mechanisms to remotely configure the parameters used by an SNMP entity for the generation of SNMP messages.

Copyright (C) The Internet Society (2002). This version of this MIB module is part of RFC 3413; see the RFC itself for full legal notices.

"
 REVISION "200210140000Z" -- 14 October 2002
 DESCRIPTION "Fixed DISPLAY-HINTS for UTF-8 strings, fixed hex value of LF characters, clarified meaning of zero length tag values, improved tag list examples. Published as RFC 3413."
 REVISION "199808040000Z" -- 4 August 1998
 DESCRIPTION "Clarifications, published as RFC 2573."
 REVISION "199707140000Z" -- 14 July 1997
 DESCRIPTION "The initial revision, published as RFC2273."
 ::= { snmpModules 12 }

snmpTargetObjects OBJECT IDENTIFIER ::= { snmpTargetMIB 1 }
 snmpTargetConformance OBJECT IDENTIFIER ::= { snmpTargetMIB 3 }

SnmptagValue ::= TEXTUAL-CONVENTION

DISPLAY-HINT "255t"

STATUS current

DESCRIPTION

"An octet string containing a tag value.
 Tag values are preferably in human-readable form.

To facilitate internationalization, this information is represented using the ISO/IEC IS 10646-1 character set, encoded as an octet string using the UTF-8 character encoding scheme described in RFC 2279.

Since additional code points are added by amendments to the 10646 standard from time to time, implementations must be prepared to encounter any code point from 0x00000000 to 0x7fffffff.

The use of control codes should be avoided, and certain

control codes are not allowed as described below.

For code points not directly supported by user interface hardware or software, an alternative means of entry and display, such as hexadecimal, may be provided.

For information encoded in 7-bit US-ASCII, the UTF-8 representation is identical to the US-ASCII encoding.

Note that when this TC is used for an object that is used or envisioned to be used as an index, then a SIZE restriction must be specified so that the number of sub-identifiers for any object instance does not exceed the limit of 128, as defined by [RFC1905].

An object of this type contains a single tag value which is used to select a set of entries in a table.

A tag value is an arbitrary string of octets, but may not contain a delimiter character. Delimiter characters are defined to be one of the following:

- An ASCII space character (0x20).
- An ASCII TAB character (0x09).
- An ASCII carriage return (CR) character (0x0D).
- An ASCII line feed (LF) character (0x0A).

Delimiter characters are used to separate tag values in a tag list. An object of this type may only contain a single tag value, and so delimiter characters are not allowed in a value of this type.

Note that a tag value of 0 length means that no tag is defined. In other words, a tag value of 0 length would never match anything in a tag list, and would never select any table entries.

Some examples of valid tag values are:

- 'acme'
- 'router'
- 'host'

The use of a tag value to select table entries is application and MIB specific."

SYNTAX OCTET STRING (SIZE (0..255))

SnmptagList ::= TEXTUAL-CONVENTION

DISPLAY-HINT "255t"

STATUS current

DESCRIPTION

"An octet string containing a list of tag values.
Tag values are preferably in human-readable form.

To facilitate internationalization, this information is represented using the ISO/IEC IS 10646-1 character set, encoded as an octet string using the UTF-8 character encoding scheme described in RFC 2279.

Since additional code points are added by amendments to the 10646 standard from time to time, implementations must be prepared to encounter any code point from 0x00000000 to 0x7fffffff.

The use of control codes should be avoided, except as described below.

For code points not directly supported by user interface hardware or software, an alternative means of entry and display, such as hexadecimal, may be provided.

For information encoded in 7-bit US-ASCII, the UTF-8 representation is identical to the US-ASCII encoding.

An object of this type contains a list of tag values which are used to select a set of entries in a table.

A tag value is an arbitrary string of octets, but may not contain a delimiter character. Delimiter characters are defined to be one of the following:

- An ASCII space character (0x20).
- An ASCII TAB character (0x09).
- An ASCII carriage return (CR) character (0x0D).
- An ASCII line feed (LF) character (0x0A).

Delimiter characters are used to separate tag values

in a tag list. Only a single delimiter character may occur between two tag values. A tag value may not have a zero length. These constraints imply certain restrictions on the contents of this object:

- There cannot be a leading or trailing delimiter character.
- There cannot be multiple adjacent delimiter characters.

Some examples of valid tag lists are:

- '' -- an empty list
- 'acme' -- list of one tag
- 'host router bridge' -- list of several tags

Note that although a tag value may not have a length of zero, an empty string is still valid. This indicates an empty list (i.e. there are no tag values in the list).

The use of the tag list to select table entries is application and MIB specific. Typically, an application will provide one or more tag values, and any entry which contains some combination of these tag values will be selected."

SYNTAX OCTET STRING (SIZE (0..255))

--
--
--
--

The snmpTargetObjects group

snmpTargetSpinLock OBJECT-TYPE

SYNTAX TestAndIncr

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This object is used to facilitate modification of table entries in the SNMP-TARGET-MIB module by multiple managers. In particular, it is useful when modifying the value of the snmpTargetAddrTagList object.

The procedure for modifying the snmpTargetAddrTagList object is as follows:

1. Retrieve the value of snmpTargetSpinLock and of snmpTargetAddrTagList.
 2. Generate a new value for snmpTargetAddrTagList.
 3. Set the value of snmpTargetSpinLock to the retrieved value, and the value of snmpTargetAddrTagList to the new value. If the set fails for the snmpTargetSpinLock object, go back to step 1."
- ::= { snmpTargetObjects 1 }

snmpTargetAddrTable OBJECT-TYPE
 SYNTAX SEQUENCE OF SnmpTargetAddrEntry
 MAX-ACCESS not-accessible
 STATUS current
 DESCRIPTION
 "A table of transport addresses to be used in the generation of SNMP messages."
 ::= { snmpTargetObjects 2 }

snmpTargetAddrEntry OBJECT-TYPE
 SYNTAX SnmpTargetAddrEntry
 MAX-ACCESS not-accessible
 STATUS current
 DESCRIPTION
 "A transport address to be used in the generation of SNMP operations.

 Entries in the snmpTargetAddrTable are created and deleted using the snmpTargetAddrRowStatus object."
 INDEX { IMPLIED snmpTargetAddrName }
 ::= { snmpTargetAddrTable 1 }

SnmpTargetAddrEntry ::= SEQUENCE {
 snmpTargetAddrName SnmpAdminString,
 snmpTargetAddrTDomain TDomain,
 snmpTargetAddrTAddress TAddress,
 snmpTargetAddrTimeout TimeInterval,
 snmpTargetAddrRetryCount Integer32,
 snmpTargetAddrTagList SnmpTagList,
 snmpTargetAddrParams SnmpAdminString,
 snmpTargetAddrStorageType StorageType,
 snmpTargetAddrRowStatus RowStatus
 }

snmpTargetAddrName OBJECT-TYPE
 SYNTAX SnmpAdminString (SIZE(1..32))

```
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
    "The locally arbitrary, but unique identifier associated
    with this snmpTargetAddrEntry."
 ::= { snmpTargetAddrEntry 1 }
```

```
snmpTargetAddrTDomain OBJECT-TYPE
SYNTAX TDomain
MAX-ACCESS read-create
STATUS current
DESCRIPTION
    "This object indicates the transport type of the address
    contained in the snmpTargetAddrTAddress object."
 ::= { snmpTargetAddrEntry 2 }
```

```
snmpTargetAddrTAddress OBJECT-TYPE
SYNTAX TAddress
MAX-ACCESS read-create
STATUS current
DESCRIPTION
    "This object contains a transport address. The format of
    this address depends on the value of the
    snmpTargetAddrTDomain object."
 ::= { snmpTargetAddrEntry 3 }
```

```
snmpTargetAddrTimeout OBJECT-TYPE
SYNTAX TimeInterval
MAX-ACCESS read-create
STATUS current
DESCRIPTION
    "This object should reflect the expected maximum round
    trip time for communicating with the transport address
    defined by this row. When a message is sent to this
    address, and a response (if one is expected) is not
    received within this time period, an implementation
    may assume that the response will not be delivered.
```

Note that the time interval that an application waits for a response may actually be derived from the value of this object. The method for deriving the actual time interval is implementation dependent. One such method is to derive the expected round trip time based on a particular retransmission algorithm and on the number of timeouts which have occurred. The type of message may also be considered when deriving expected round trip times for retransmissions. For example, if a message is being sent with a securityLevel that indicates both

authentication and privacy, the derived value may be increased to compensate for extra processing time spent during authentication and encryption processing."

```
DEFVAL { 1500 }
 ::= { snmpTargetAddrEntry 4 }
```

snmpTargetAddrRetryCount OBJECT-TYPE

```
SYNTAX      Integer32 (0..255)
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
    "This object specifies a default number of retries to be
    attempted when a response is not received for a generated
    message.  An application may provide its own retry count,
    in which case the value of this object is ignored."
DEFVAL { 3 }
 ::= { snmpTargetAddrEntry 5 }
```

snmpTargetAddrTagList OBJECT-TYPE

```
SYNTAX      SnmpTagList
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
    "This object contains a list of tag values which are
    used to select target addresses for a particular
    operation."
DEFVAL { "" }
 ::= { snmpTargetAddrEntry 6 }
```

snmpTargetAddrParams OBJECT-TYPE

```
SYNTAX      SnmpAdminString (SIZE(1..32))
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
    "The value of this object identifies an entry in the
    snmpTargetParamsTable.  The identified entry
    contains SNMP parameters to be used when generating
    messages to be sent to this transport address."
 ::= { snmpTargetAddrEntry 7 }
```

snmpTargetAddrStorageType OBJECT-TYPE

```
SYNTAX      StorageType
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
    "The storage type for this conceptual row.
    Conceptual rows having the value 'permanent' need not
    allow write-access to any columnar objects in the row."
```

```
DEFVAL { nonVolatile }
 ::= { snmpTargetAddrEntry 8 }
```

```
snmpTargetAddrRowStatus OBJECT-TYPE
```

```
SYNTAX      RowStatus
MAX-ACCESS  read-create
STATUS      current
```

```
DESCRIPTION
```

"The status of this conceptual row.

To create a row in this table, a manager must set this object to either createAndGo(4) or createAndWait(5).

Until instances of all corresponding columns are appropriately configured, the value of the corresponding instance of the snmpTargetAddrRowStatus column is 'notReady'.

In particular, a newly created row cannot be made active until the corresponding instances of snmpTargetAddrTDomain, snmpTargetAddrTAddress, and snmpTargetAddrParams have all been set.

The following objects may not be modified while the value of this object is active(1):

- snmpTargetAddrTDomain
- snmpTargetAddrTAddress

An attempt to set these objects while the value of snmpTargetAddrRowStatus is active(1) will result in an inconsistentValue error."

```
 ::= { snmpTargetAddrEntry 9 }
```

```
snmpTargetParamsTable OBJECT-TYPE
```

```
SYNTAX      SEQUENCE OF SnmpTargetParamsEntry
MAX-ACCESS  not-accessible
STATUS      current
```

```
DESCRIPTION
```

"A table of SNMP target information to be used in the generation of SNMP messages."

```
 ::= { snmpTargetObjects 3 }
```

```
snmpTargetParamsEntry OBJECT-TYPE
```

```
SYNTAX      SnmpTargetParamsEntry
MAX-ACCESS  not-accessible
STATUS      current
```

```
DESCRIPTION
```

"A set of SNMP target information.

```

        Entries in the snmpTargetParamsTable are created and
        deleted using the snmpTargetParamsRowStatus object."
INDEX { IMPLIED snmpTargetParamsName }
 ::= { snmpTargetParamsTable 1 }

SnmpTargetParamsEntry ::= SEQUENCE {
    snmpTargetParamsName          SnmpAdminString,
    snmpTargetParamsMPModel      SnmpMessageProcessingModel,
    snmpTargetParamsSecurityModel SnmpSecurityModel,
    snmpTargetParamsSecurityName SnmpAdminString,
    snmpTargetParamsSecurityLevel SnmpSecurityLevel,
    snmpTargetParamsStorageType  StorageType,
    snmpTargetParamsRowStatus    RowStatus
}

snmpTargetParamsName OBJECT-TYPE
    SYNTAX      SnmpAdminString (SIZE(1..32))
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The locally arbitrary, but unique identifier associated
        with this snmpTargetParamsEntry."
    ::= { snmpTargetParamsEntry 1 }

snmpTargetParamsMPModel OBJECT-TYPE
    SYNTAX      SnmpMessageProcessingModel
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The Message Processing Model to be used when generating
        SNMP messages using this entry."
    ::= { snmpTargetParamsEntry 2 }

snmpTargetParamsSecurityModel OBJECT-TYPE
    SYNTAX      SnmpSecurityModel (1..2147483647)
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The Security Model to be used when generating SNMP
        messages using this entry.  An implementation may
        choose to return an inconsistentValue error if an
        attempt is made to set this variable to a value
        for a security model which the implementation does
        not support."
    ::= { snmpTargetParamsEntry 3 }

snmpTargetParamsSecurityName OBJECT-TYPE
    SYNTAX      SnmpAdminString

```

```
MAX-ACCESS read-create
STATUS current
DESCRIPTION
    "The securityName which identifies the Principal on
    whose behalf SNMP messages will be generated using
    this entry."
 ::= { snmpTargetParamsEntry 4 }

snmpTargetParamsSecurityLevel OBJECT-TYPE
SYNTAX SnmpSecurityLevel
MAX-ACCESS read-create
STATUS current
DESCRIPTION
    "The Level of Security to be used when generating
    SNMP messages using this entry."
 ::= { snmpTargetParamsEntry 5 }

snmpTargetParamsStorageType OBJECT-TYPE
SYNTAX StorageType
MAX-ACCESS read-create
STATUS current
DESCRIPTION
    "The storage type for this conceptual row.
    Conceptual rows having the value 'permanent' need not
    allow write-access to any columnar objects in the row."
DEFVAL { nonVolatile }
 ::= { snmpTargetParamsEntry 6 }

snmpTargetParamsRowStatus OBJECT-TYPE
SYNTAX RowStatus
MAX-ACCESS read-create
STATUS current
DESCRIPTION
    "The status of this conceptual row.

    To create a row in this table, a manager must
    set this object to either createAndGo(4) or
    createAndWait(5).

    Until instances of all corresponding columns are
    appropriately configured, the value of the
    corresponding instance of the snmpTargetParamsRowStatus
    column is 'notReady'.

    In particular, a newly created row cannot be made
    active until the corresponding
    snmpTargetParamsMPModel,
    snmpTargetParamsSecurityModel,
```

snmpTargetParamsSecurityName,
and snmpTargetParamsSecurityLevel have all been set.

The following objects may not be modified while the
value of this object is active(1):

- snmpTargetParamsMPModel
- snmpTargetParamsSecurityModel
- snmpTargetParamsSecurityName
- snmpTargetParamsSecurityLevel

An attempt to set these objects while the value of
snmpTargetParamsRowStatus is active(1) will result in
an inconsistentValue error."

```
::= { snmpTargetParamsEntry 7 }
```

```
snmpUnavailableContexts OBJECT-TYPE
```

```
SYNTAX Counter32
```

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

```
STATUS current
```

```
DESCRIPTION
```

```
"The total number of packets received by the SNMP  
engine which were dropped because the context  
contained in the message was unavailable."
```

```
::= { snmpTargetObjects 4 }
```

```
snmpUnknownContexts OBJECT-TYPE
```

```
SYNTAX Counter32
```

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

```
STATUS current
```

```
DESCRIPTION
```

```
"The total number of packets received by the SNMP  
engine which were dropped because the context  
contained in the message was unknown."
```

```
::= { snmpTargetObjects 5 }
```

```
--
```

```
--
```

```
-- Conformance information
```

```
--
```

```
--
```

```
snmpTargetCompliances OBJECT IDENTIFIER ::=
```

```
{ snmpTargetConformance 1 }
```

```
snmpTargetGroups OBJECT IDENTIFIER ::=
```

```
{ snmpTargetConformance 2 }
```

```
--
```

```
--
```

```
-- Compliance statements
```

```
--  
--
```

```
snmpTargetCommandResponderCompliance MODULE-COMPLIANCE  
  STATUS      current  
  DESCRIPTION  
    "The compliance statement for SNMP entities which include  
    a command responder application."  
  MODULE -- This Module  
    MANDATORY-GROUPS { snmpTargetCommandResponderGroup }  
  ::= { snmpTargetCompliances 1 }
```

```
snmpTargetBasicGroup OBJECT-GROUP  
  OBJECTS {  
    snmpTargetSpinLock,  
    snmpTargetAddrTDomain,  
    snmpTargetAddrTAddress,  
    snmpTargetAddrTagList,  
    snmpTargetAddrParams,  
    snmpTargetAddrStorageType,  
    snmpTargetAddrRowStatus,  
    snmpTargetParamsMPModel,  
    snmpTargetParamsSecurityModel,  
    snmpTargetParamsSecurityName,  
    snmpTargetParamsSecurityLevel,  
    snmpTargetParamsStorageType,  
    snmpTargetParamsRowStatus  
  }  
  STATUS      current  
  DESCRIPTION  
    "A collection of objects providing basic remote  
    configuration of management targets."  
  ::= { snmpTargetGroups 1 }
```

```
snmpTargetResponseGroup OBJECT-GROUP  
  OBJECTS {  
    snmpTargetAddrTimeout,  
    snmpTargetAddrRetryCount  
  }  
  STATUS      current  
  DESCRIPTION  
    "A collection of objects providing remote configuration  
    of management targets for applications which generate  
    SNMP messages for which a response message would be  
    expected."  
  ::= { snmpTargetGroups 2 }
```

```
snmpTargetCommandResponderGroup OBJECT-GROUP
```

```

OBJECTS {
    snmpUnavailableContexts,
    snmpUnknownContexts
}
STATUS      current
DESCRIPTION
    "A collection of objects required for command responder
    applications, used for counting error conditions."
 ::= { snmpTargetGroups 3 }

```

END

4.2. The Notification MIB Module

The SNMP-NOTIFICATION-MIB module contains objects for the remote configuration of the parameters used by an SNMP entity for the generation of notifications. It consists of three tables and conformance/compliance statements. The first table, the `snmpNotifyTable`, contains entries which select which entries in the `snmpTargetAddrTable` should be used for generating notifications, and the type of notifications to be generated.

The second table, the `snmpNotifyFilterProfileTable`, sparsely augments the `snmpTargetParamsTable` with an object which is used to associate a set of filters with a particular management target.

The third table, the `snmpNotifyFilterTable`, defines filters which are used to limit the number of notifications which are generated using particular management targets.

4.2.1. Definitions

```
SNMP-NOTIFICATION-MIB DEFINITIONS ::= BEGIN
```

```

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

    RowStatus,
    StorageType
        FROM SNMPv2-TC

    SnmpAdminString
        FROM SNMP-FRAMEWORK-MIB

    SnmpTagValue,

```

```
snmpTargetParamsName
  FROM SNMP-TARGET-MIB

MODULE-COMPLIANCE,
OBJECT-GROUP
  FROM SNMPv2-CONF;

snmpNotificationMIB MODULE-IDENTITY
  LAST-UPDATED "200210140000Z"
  ORGANIZATION "IETF SNMPv3 Working Group"
  CONTACT-INFO
    "WG-email:      snmpv3@lists.tislabs.com
    Subscribe:    :majordomo@lists.tislabs.com
    In message body: subscribe snmpv3

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    Co-editor:     Bob Stewart
                   Retired"
```

DESCRIPTION

"This MIB module defines MIB objects which provide mechanisms to remotely configure the parameters used by an SNMP entity for the generation of notifications.

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"

```

REVISION      "200210140000Z"          -- 14 October 2002
DESCRIPTION   "Clarifications, published as
              RFC 3413."
REVISION      "199808040000Z"          -- 4 August 1998
DESCRIPTION   "Clarifications, published as
              RFC 2573."
REVISION      "199707140000Z"          -- 14 July 1997
DESCRIPTION   "The initial revision, published as RFC2273."
 ::= { snmpModules 13 }

```

```

snmpNotifyObjects      OBJECT IDENTIFIER ::=
                        { snmpNotificationMIB 1 }
snmpNotifyConformance OBJECT IDENTIFIER ::=
                        { snmpNotificationMIB 3 }

```

--

--

-- The snmpNotifyObjects group

--

--

```

snmpNotifyTable OBJECT-TYPE
  SYNTAX      SEQUENCE OF SnmpNotifyEntry
  MAX-ACCESS  not-accessible
  STATUS      current
  DESCRIPTION
    "This table is used to select management targets which should
     receive notifications, as well as the type of notification
     which should be sent to each selected management target."
  ::= { snmpNotifyObjects 1 }

```

```

snmpNotifyEntry OBJECT-TYPE
  SYNTAX      SnmpNotifyEntry
  MAX-ACCESS  not-accessible
  STATUS      current
  DESCRIPTION
    "An entry in this table selects a set of management targets
     which should receive notifications, as well as the type of

```

notification which should be sent to each selected management target.

Entries in the snmpNotifyTable are created and deleted using the snmpNotifyRowStatus object."

```
INDEX { IMPLIED snmpNotifyName }
 ::= { snmpNotifyTable 1 }
```

```
SnmpNotifyEntry ::= SEQUENCE {
    snmpNotifyName      SnmpAdminString,
    snmpNotifyTag       SnmpTagValue,
    snmpNotifyType      INTEGER,
    snmpNotifyStorageType StorageType,
    snmpNotifyRowStatus RowStatus
}
```

```
snmpNotifyName OBJECT-TYPE
    SYNTAX      SnmpAdminString (SIZE(1..32))
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The locally arbitrary, but unique identifier associated
         with this snmpNotifyEntry."
    ::= { snmpNotifyEntry 1 }
```

```
snmpNotifyTag OBJECT-TYPE
    SYNTAX      SnmpTagValue
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "This object contains a single tag value which is used
         to select entries in the snmpTargetAddrTable. Any entry
         in the snmpTargetAddrTable which contains a tag value
         which is equal to the value of an instance of this
         object is selected. If this object contains a value
         of zero length, no entries are selected."
    DEFVAL { "" }
    ::= { snmpNotifyEntry 2 }
```

```
snmpNotifyType OBJECT-TYPE
    SYNTAX      INTEGER {
                    trap(1),
                    inform(2)
                }
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "This object determines the type of notification to
```

be generated for entries in the `snmpTargetAddrTable` selected by the corresponding instance of `snmpNotifyTag`. This value is only used when generating notifications, and is ignored when using the `snmpTargetAddrTable` for other purposes.

If the value of this object is `trap(1)`, then any messages generated for selected rows will contain Unconfirmed-Class PDUs.

If the value of this object is `inform(2)`, then any messages generated for selected rows will contain Confirmed-Class PDUs.

Note that if an SNMP entity only supports generation of Unconfirmed-Class PDUs (and not Confirmed-Class PDUs), then this object may be read-only."

```
DEFVAL { trap }
 ::= { snmpNotifyEntry 3 }
```

`snmpNotifyStorageType` OBJECT-TYPE

```
SYNTAX      StorageType
MAX-ACCESS  read-create
STATUS      current
```

DESCRIPTION

"The storage type for this conceptual row. Conceptual rows having the value 'permanent' need not allow write-access to any columnar objects in the row."

```
DEFVAL { nonVolatile }
 ::= { snmpNotifyEntry 4 }
```

`snmpNotifyRowStatus` OBJECT-TYPE

```
SYNTAX      RowStatus
MAX-ACCESS  read-create
STATUS      current
```

DESCRIPTION

"The status of this conceptual row.

To create a row in this table, a manager must set this object to either `createAndGo(4)` or `createAndWait(5)`."

```
 ::= { snmpNotifyEntry 5 }
```

`snmpNotifyFilterProfileTable` OBJECT-TYPE

```
SYNTAX      SEQUENCE OF SnmpNotifyFilterProfileEntry
MAX-ACCESS  not-accessible
STATUS      current
```

DESCRIPTION

"This table is used to associate a notification filter profile with a particular set of target parameters."
 ::= { snmpNotifyObjects 2 }

snmpNotifyFilterProfileEntry OBJECT-TYPE

SYNTAX SnmpNotifyFilterProfileEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table indicates the name of the filter profile to be used when generating notifications using the corresponding entry in the snmpTargetParamsTable.

Entries in the snmpNotifyFilterProfileTable are created and deleted using the snmpNotifyFilterProfileRowStatus object."

INDEX { IMPLIED snmpTargetParamsName }

::= { snmpNotifyFilterProfileTable 1 }

SnmpNotifyFilterProfileEntry ::= SEQUENCE {

snmpNotifyFilterProfileName SnmpAdminString,

snmpNotifyFilterProfileStorType StorageType,

snmpNotifyFilterProfileRowStatus RowStatus

}

snmpNotifyFilterProfileName OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE(1..32))

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The name of the filter profile to be used when generating notifications using the corresponding entry in the snmpTargetAddrTable."

::= { snmpNotifyFilterProfileEntry 1 }

snmpNotifyFilterProfileStorType OBJECT-TYPE

SYNTAX StorageType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The storage type for this conceptual row. Conceptual rows having the value 'permanent' need not allow write-access to any columnar objects in the row."

DEFVAL { nonVolatile }

::= { snmpNotifyFilterProfileEntry 2 }

snmpNotifyFilterProfileRowStatus OBJECT-TYPE

```
SYNTAX      RowStatus
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
```

"The status of this conceptual row.

To create a row in this table, a manager must set this object to either createAndGo(4) or createAndWait(5).

Until instances of all corresponding columns are appropriately configured, the value of the corresponding instance of the snmpNotifyFilterProfileRowStatus column is 'notReady'.

In particular, a newly created row cannot be made active until the corresponding instance of snmpNotifyFilterProfileName has been set."

```
::= { snmpNotifyFilterProfileEntry 3 }
```

```
snmpNotifyFilterTable OBJECT-TYPE
```

```
SYNTAX      SEQUENCE OF SnmpNotifyFilterEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
```

"The table of filter profiles. Filter profiles are used to determine whether particular management targets should receive particular notifications.

When a notification is generated, it must be compared with the filters associated with each management target which is configured to receive notifications, in order to determine whether it may be sent to each such management target.

A more complete discussion of notification filtering can be found in section 6. of [SNMP-APPL]."

```
::= { snmpNotifyObjects 3 }
```

```
snmpNotifyFilterEntry OBJECT-TYPE
```

```
SYNTAX      SnmpNotifyFilterEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
```

"An element of a filter profile.

Entries in the snmpNotifyFilterTable are created and deleted using the snmpNotifyFilterRowStatus object."

```

INDEX {          snmpNotifyFilterProfileName,
              IMPLIED snmpNotifyFilterSubtree }
 ::= { snmpNotifyFilterTable 1 }

SnmpNotifyFilterEntry ::= SEQUENCE {
    snmpNotifyFilterSubtree      OBJECT IDENTIFIER,
    snmpNotifyFilterMask        OCTET STRING,
    snmpNotifyFilterType        INTEGER,
    snmpNotifyFilterStorageType StorageType,
    snmpNotifyFilterRowStatus    RowStatus
}

snmpNotifyFilterSubtree OBJECT-TYPE
    SYNTAX      OBJECT IDENTIFIER
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The MIB subtree which, when combined with the corresponding
        instance of snmpNotifyFilterMask, defines a family of
        subtrees which are included in or excluded from the
        filter profile."
    ::= { snmpNotifyFilterEntry 1 }

snmpNotifyFilterMask OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE(0..16))
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The bit mask which, in combination with the corresponding
        instance of snmpNotifyFilterSubtree, defines a family of
        subtrees which are included in or excluded from the
        filter profile.

        Each bit of this bit mask corresponds to a
        sub-identifier of snmpNotifyFilterSubtree, with the
        most significant bit of the i-th octet of this octet
        string value (extended if necessary, see below)
        corresponding to the (8*i - 7)-th sub-identifier, and
        the least significant bit of the i-th octet of this
        octet string corresponding to the (8*i)-th
        sub-identifier, where i is in the range 1 through 16.

        Each bit of this bit mask specifies whether or not
        the corresponding sub-identifiers must match when
        determining if an OBJECT IDENTIFIER matches this
        family of filter subtrees; a '1' indicates that an
        exact match must occur; a '0' indicates 'wild card',
        i.e., any sub-identifier value matches."

```

Thus, the OBJECT IDENTIFIER X of an object instance is contained in a family of filter subtrees if, for each sub-identifier of the value of snmpNotifyFilterSubtree, either:

the i-th bit of snmpNotifyFilterMask is 0, or

the i-th sub-identifier of X is equal to the i-th sub-identifier of the value of snmpNotifyFilterSubtree.

If the value of this bit mask is M bits long and there are more than M sub-identifiers in the corresponding instance of snmpNotifyFilterSubtree, then the bit mask is extended with 1's to be the required length.

Note that when the value of this object is the zero-length string, this extension rule results in a mask of all-1's being used (i.e., no 'wild card'), and the family of filter subtrees is the one subtree uniquely identified by the corresponding instance of snmpNotifyFilterSubtree."

```
DEFVAL { ''H }
 ::= { snmpNotifyFilterEntry 2 }
```

```
snmpNotifyFilterType OBJECT-TYPE
```

```
SYNTAX      INTEGER {
                included(1),
                excluded(2)
            }
```

```
MAX-ACCESS  read-create
```

```
STATUS      current
```

```
DESCRIPTION
```

```
"This object indicates whether the family of filter subtrees
defined by this entry are included in or excluded from a
filter.  A more detailed discussion of the use of this
object can be found in section 6. of [SNMP-APPL]."
```

```
DEFVAL { included }
 ::= { snmpNotifyFilterEntry 3 }
```

```
snmpNotifyFilterStorageType OBJECT-TYPE
```

```
SYNTAX      StorageType
```

```
MAX-ACCESS  read-create
```

```
STATUS      current
```

```
DESCRIPTION
```

```
"The storage type for this conceptual row.
Conceptual rows having the value 'permanent' need not
```

```

        allow write-access to any columnar objects in the row."
DEFVAL { nonVolatile }
 ::= { snmpNotifyFilterEntry 4 }

snmpNotifyFilterRowStatus OBJECT-TYPE
SYNTAX      RowStatus
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
    "The status of this conceptual row.

    To create a row in this table, a manager must
    set this object to either createAndGo(4) or
    createAndWait(5)."
```

```
 ::= { snmpNotifyFilterEntry 5 }

--
--
-- Conformance information
--
--

snmpNotifyCompliances OBJECT IDENTIFIER ::=
                                { snmpNotifyConformance 1 }
snmpNotifyGroups      OBJECT IDENTIFIER ::=
                                { snmpNotifyConformance 2 }

--
--
-- Compliance statements
--
--

snmpNotifyBasicCompliance MODULE-COMPLIANCE
STATUS      current
DESCRIPTION
    "The compliance statement for minimal SNMP entities which
    implement only SNMP Unconfirmed-Class notifications and
    read-create operations on only the snmpTargetAddrTable."
MODULE SNMP-TARGET-MIB
MANDATORY-GROUPS { snmpTargetBasicGroup }

OBJECT snmpTargetParamsMPModel
MIN-ACCESS  read-only
DESCRIPTION
    "Create/delete/modify access is not required."

OBJECT snmpTargetParamsSecurityModel
```

```
MIN-ACCESS    read-only
DESCRIPTION
    "Create/delete/modify access is not required."

OBJECT snmpTargetParamsSecurityName
MIN-ACCESS    read-only
DESCRIPTION
    "Create/delete/modify access is not required."

OBJECT snmpTargetParamsSecurityLevel
MIN-ACCESS    read-only
DESCRIPTION
    "Create/delete/modify access is not required."

OBJECT snmpTargetParamsStorageType
SYNTAX INTEGER {
    readOnly(5)
}
MIN-ACCESS    read-only
DESCRIPTION
    "Create/delete/modify access is not required.
    Support of the values other(1), volatile(2),
    nonVolatile(3), and permanent(4) is not required."

OBJECT snmpTargetParamsRowStatus
SYNTAX INTEGER {
    active(1)
}
MIN-ACCESS    read-only
DESCRIPTION
    "Create/delete/modify access to the
    snmpTargetParamsTable is not required.
    Support of the values notInService(2), notReady(3),
    createAndGo(4), createAndWait(5), and destroy(6) is
    not required."

MODULE -- This Module
MANDATORY-GROUPS { snmpNotifyGroup }

OBJECT snmpNotifyTag
MIN-ACCESS    read-only
DESCRIPTION
    "Create/delete/modify access is not required."

OBJECT snmpNotifyType
SYNTAX INTEGER {
    trap(1)
}
```

```

MIN-ACCESS      read-only
DESCRIPTION
    "Create/delete/modify access is not required.
    Support of the value notify(2) is not required."

OBJECT snmpNotifyStorageType
SYNTAX INTEGER {
    readOnly(5)
}
MIN-ACCESS      read-only
DESCRIPTION
    "Create/delete/modify access is not required.
    Support of the values other(1), volatile(2),
    nonVolatile(3), and permanent(4) is not required."

OBJECT snmpNotifyRowStatus
SYNTAX INTEGER {
    active(1)
}
MIN-ACCESS      read-only
DESCRIPTION
    "Create/delete/modify access to the
    snmpNotifyTable is not required.
    Support of the values notInService(2), notReady(3),
    createAndGo(4), createAndWait(5), and destroy(6) is
    not required."

```

```
 ::= { snmpNotifyCompliances 1 }
```

```

snmpNotifyBasicFiltersCompliance MODULE-COMPLIANCE
STATUS      current
DESCRIPTION
    "The compliance statement for SNMP entities which implement
    SNMP Unconfirmed-Class notifications with filtering, and
    read-create operations on all related tables."
MODULE SNMP-TARGET-MIB
MANDATORY-GROUPS { snmpTargetBasicGroup }
MODULE -- This Module
MANDATORY-GROUPS { snmpNotifyGroup,
                    snmpNotifyFilterGroup }
 ::= { snmpNotifyCompliances 2 }

```

```

snmpNotifyFullCompliance MODULE-COMPLIANCE
STATUS      current
DESCRIPTION
    "The compliance statement for SNMP entities which either
    implement only SNMP Confirmed-Class notifications, or both
    SNMP Unconfirmed-Class and Confirmed-Class notifications,

```

```
        plus filtering and read-create operations on all related
        tables."
MODULE SNMP-TARGET-MIB
    MANDATORY-GROUPS { snmpTargetBasicGroup,
                        snmpTargetResponseGroup }
MODULE -- This Module
    MANDATORY-GROUPS { snmpNotifyGroup,
                        snmpNotifyFilterGroup }
 ::= { snmpNotifyCompliances 3 }

snmpNotifyGroup OBJECT-GROUP
    OBJECTS {
        snmpNotifyTag,
        snmpNotifyType,
        snmpNotifyStorageType,
        snmpNotifyRowStatus
    }
    STATUS          current
    DESCRIPTION
        "A collection of objects for selecting which management
        targets are used for generating notifications, and the
        type of notification to be generated for each selected
        management target."
 ::= { snmpNotifyGroups 1 }

snmpNotifyFilterGroup OBJECT-GROUP
    OBJECTS {
        snmpNotifyFilterProfileName,
        snmpNotifyFilterProfileStorType,
        snmpNotifyFilterProfileRowStatus,
        snmpNotifyFilterMask,
        snmpNotifyFilterType,
        snmpNotifyFilterStorageType,
        snmpNotifyFilterRowStatus
    }
    STATUS          current
    DESCRIPTION
        "A collection of objects providing remote configuration
        of notification filters."
 ::= { snmpNotifyGroups 2 }

END
```

4.3. The Proxy MIB Module

The SNMP-PROXY-MIB module, which defines MIB objects that provide mechanisms to remotely configure the parameters used by an SNMP entity for proxy forwarding operations, contains a single table. This table, `snmpProxyTable`, is used to define translations between management targets for use when forwarding messages.

4.3.1. Definitions

```
SNMP-PROXY-MIB DEFINITIONS ::= BEGIN
```

```
IMPORTS
```

```
    MODULE-IDENTITY,  
    OBJECT-TYPE,  
    snmpModules  
        FROM SNMPv2-SMI
```

```
    RowStatus,  
    StorageType  
        FROM SNMPv2-TC
```

```
    SnmpEngineID,  
    SnmpAdminString  
        FROM SNMP-FRAMEWORK-MIB
```

```
    SnmpTagValue  
        FROM SNMP-TARGET-MIB
```

```
    MODULE-COMPLIANCE,  
    OBJECT-GROUP  
        FROM SNMPv2-CONF;
```

```
snmpProxyMIB MODULE-IDENTITY
```

```
    LAST-UPDATED "200210140000Z"
```

```
    ORGANIZATION "IETF SNMPv3 Working Group"
```

```
    CONTACT-INFO
```

```
        "WG-email:    snmpv3@lists.tislabs.com  
        Subscribe:   majordomo@lists.tislabs.com  
                    In message body:  subscribe snmpv3
```

```
        Co-Chair:    Russ Mundy  
                    Network Associates Laboratories  
                    15204 Omega Drive, Suite 300  
                    Rockville, MD 20850-4601  
                    USA
```

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```

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DESCRIPTION

"This MIB module defines MIB objects which provide mechanisms to remotely configure the parameters used by a proxy forwarding application.

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"

```
REVISION      "200210140000Z"          -- 14 October 2002
DESCRIPTION   "Clarifications, published as
              RFC 3413."
REVISION      "199808040000Z"          -- 4 August 1998
DESCRIPTION   "Clarifications, published as
              RFC 2573."
REVISION      "199707140000Z"          -- 14 July 1997
DESCRIPTION   "The initial revision, published as RFC2273."
 ::= { snmpModules 14 }
```

```
snmpProxyObjects      OBJECT IDENTIFIER ::= { snmpProxyMIB 1 }
snmpProxyConformance OBJECT IDENTIFIER ::= { snmpProxyMIB 3 }
```

--

```

--
-- The snmpProxyObjects group
--
--

snmpProxyTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF SnmpProxyEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The table of translation parameters used by proxy forwarder
        applications for forwarding SNMP messages."
    ::= { snmpProxyObjects 2 }

snmpProxyEntry OBJECT-TYPE
    SYNTAX      SnmpProxyEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A set of translation parameters used by a proxy forwarder
        application for forwarding SNMP messages.

        Entries in the snmpProxyTable are created and deleted
        using the snmpProxyRowStatus object."
    INDEX { IMPLIED snmpProxyName }
    ::= { snmpProxyTable 1 }

SnmpProxyEntry ::= SEQUENCE {
    snmpProxyName          SnmpAdminString,
    snmpProxyType          INTEGER,
    snmpProxyContextEngineID SnmpEngineID,
    snmpProxyContextName   SnmpAdminString,
    snmpProxyTargetParamsIn SnmpAdminString,
    snmpProxySingleTargetOut SnmpAdminString,
    snmpProxyMultipleTargetOut SnmpTagValue,
    snmpProxyStorageType   StorageType,
    snmpProxyRowStatus     RowStatus
}

snmpProxyName OBJECT-TYPE
    SYNTAX      SnmpAdminString (SIZE(1..32))
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The locally arbitrary, but unique identifier associated
        with this snmpProxyEntry."
    ::= { snmpProxyEntry 1 }

```

```
snmpProxyType OBJECT-TYPE
  SYNTAX      INTEGER {
                read(1),
                write(2),
                trap(3),
                inform(4)
              }
  MAX-ACCESS  read-create
  STATUS      current
  DESCRIPTION
    "The type of message that may be forwarded using
     the translation parameters defined by this entry."
 ::= { snmpProxyEntry 2 }

snmpProxyContextEngineID OBJECT-TYPE
  SYNTAX      SnmpEngineID
  MAX-ACCESS  read-create
  STATUS      current
  DESCRIPTION
    "The contextEngineID contained in messages that
     may be forwarded using the translation parameters
     defined by this entry."
 ::= { snmpProxyEntry 3 }

snmpProxyContextName OBJECT-TYPE
  SYNTAX      SnmpAdminString
  MAX-ACCESS  read-create
  STATUS      current
  DESCRIPTION
    "The contextName contained in messages that may be
     forwarded using the translation parameters defined
     by this entry.

     This object is optional, and if not supported, the
     contextName contained in a message is ignored when
     selecting an entry in the snmpProxyTable."
 ::= { snmpProxyEntry 4 }

snmpProxyTargetParamsIn OBJECT-TYPE
  SYNTAX      SnmpAdminString
  MAX-ACCESS  read-create
  STATUS      current
  DESCRIPTION
    "This object selects an entry in the snmpTargetParamsTable.
     The selected entry is used to determine which row of the
     snmpProxyTable to use for forwarding received messages."
 ::= { snmpProxyEntry 5 }
```

```
snmpProxySingleTargetOut OBJECT-TYPE
    SYNTAX      SnmpAdminString
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "This object selects a management target defined in the
        snmpTargetAddrTable (in the SNMP-TARGET-MIB).  The
        selected target is defined by an entry in the
        snmpTargetAddrTable whose index value (snmpTargetAddrName)
        is equal to this object.

        This object is only used when selection of a single
        target is required (i.e. when forwarding an incoming
        read or write request)."
```

```
 ::= { snmpProxyEntry 6 }
```

```
snmpProxyMultipleTargetOut OBJECT-TYPE
    SYNTAX      SnmpTagValue
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "This object selects a set of management targets defined
        in the snmpTargetAddrTable (in the SNMP-TARGET-MIB).

        This object is only used when selection of multiple
        targets is required (i.e. when forwarding an incoming
        notification)."
```

```
 ::= { snmpProxyEntry 7 }
```

```
snmpProxyStorageType OBJECT-TYPE
    SYNTAX      StorageType
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The storage type of this conceptual row.
        Conceptual rows having the value 'permanent' need not
        allow write-access to any columnar objects in the row."
    DEFVAL { nonVolatile }
    ::= { snmpProxyEntry 8 }
```

```
snmpProxyRowStatus OBJECT-TYPE
    SYNTAX      RowStatus
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The status of this conceptual row.

        To create a row in this table, a manager must
```

set this object to either createAndGo(4) or createAndWait(5).

The following objects may not be modified while the value of this object is active(1):

- snmpProxyType
- snmpProxyContextEngineID
- snmpProxyContextName
- snmpProxyTargetParamsIn
- snmpProxySingleTargetOut
- snmpProxyMultipleTargetOut"

```
::= { snmpProxyEntry 9 }
```

```
--
```

```
--
```

```
-- Conformance information
```

```
--
```

```
--
```

```
snmpProxyCompliances OBJECT IDENTIFIER ::=
                                { snmpProxyConformance 1 }
snmpProxyGroups      OBJECT IDENTIFIER ::=
                                { snmpProxyConformance 2 }
```

```
--
```

```
--
```

```
-- Compliance statements
```

```
--
```

```
--
```

```
snmpProxyCompliance MODULE-COMPLIANCE
    STATUS          current
    DESCRIPTION
        "The compliance statement for SNMP entities which include
         a proxy forwarding application."
    MODULE SNMP-TARGET-MIB
        MANDATORY-GROUPS { snmpTargetBasicGroup,
                           snmpTargetResponseGroup }
    MODULE -- This Module
        MANDATORY-GROUPS { snmpProxyGroup }
    ::= { snmpProxyCompliances 1 }
```

```
snmpProxyGroup OBJECT-GROUP
    OBJECTS {
        snmpProxyType,
        snmpProxyContextEngineID,
        snmpProxyContextName,
        snmpProxyTargetParamsIn,
```

```

    snmpProxySingleTargetOut,
    snmpProxyMultipleTargetOut,
    snmpProxyStorageType,
    snmpProxyRowStatus
}
STATUS          current
DESCRIPTION
    "A collection of objects providing remote configuration of
    management target translation parameters for use by
    proxy forwarder applications."
 ::= { snmpProxyGroups 3 }

```

END

5. Identification of Management Targets in Notification Originators

This section describes the mechanisms used by a notification originator application when using the MIB module described in this document to determine the set of management targets to be used when generating a notification.

A notification originator uses all active entries in the `snmpNotifyTable` to find the management targets to be used for generating notifications. Each active entry in this table selects zero or more entries in the `snmpTargetAddrTable`. When a notification is generated, it is sent to all of the targets specified by the selected `snmpTargetAddrTable` entries (subject to the application of access control and notification filtering).

Any entry in the `snmpTargetAddrTable` whose `snmpTargetAddrTagList` object contains a tag value which is equal to a value of `snmpNotifyTag` is selected by the `snmpNotifyEntry` which contains that instance of `snmpNotifyTag`. Note that a particular `snmpTargetAddrEntry` may be selected by multiple entries in the `snmpNotifyTable`, resulting in multiple notifications being generated using that `snmpTargetAddrEntry` (this allows, for example, both traps and informs to be sent to the same target).

Each `snmpTargetAddrEntry` contains a pointer to the `snmpTargetParamsTable` (`snmpTargetAddrParams`). This pointer selects a set of SNMP parameters to be used for generating notifications. If the selected entry in the `snmpTargetParamsTable` does not exist, the management target is not used to generate notifications.

The decision as to whether a notification should contain an Unconfirmed-Class or a Confirmed-Class PDU is determined by the value of the `snmpNotifyType` object. If the value of this object is `trap(1)`, the notification should contain an Unconfirmed-Class PDU.

If the value of this object is `inform(2)`, then the notification should contain a `Confirmed-Class` PDU, and the timeout time and number of retries for the notification are the value of `snmpTargetAddrTimeout` and `snmpTargetAddrRetryCount`. Note that the exception to these rules is when the `snmpTargetParamsMPModel` object indicates an SNMP version which supports a different PDU version. In this case, the notification may be sent using a different PDU type ([RFC2576] defines the PDU type in the case where the outgoing SNMP version is `SNMPv1`).

6. Notification Filtering

This section describes the mechanisms used by a notification originator application when using the MIB module described in this document to filter generation of notifications.

A notification originator uses the `snmpNotifyFilterTable` to filter notifications. A notification filter profile may be associated with a particular entry in the `snmpTargetParamsTable`. The associated filter profile is identified by an entry in the `snmpNotifyFilterProfileTable` whose index is equal to the index of the entry in the `snmpTargetParamsTable`. If no such entry exists in the `snmpNotifyFilterProfileTable`, no filtering is performed for that management target.

If such an entry does exist, the value of `snmpNotifyFilterProfileName` of the entry is compared with the corresponding portion of the index of all active entries in the `snmpNotifyFilterTable`. All such entries for which this comparison results in an exact match are used for filtering a notification generated using the associated `snmpTargetParamsEntry`. If no such entries exist, no filtering is performed, and a notification may be sent to the management target.

Otherwise, if matching entries do exist, a notification may be sent if the `NOTIFICATION-TYPE OBJECT IDENTIFIER` of the notification (this is the value of the element of the variable bindings whose name is `snmpTrapOID.0`, i.e., the second variable binding) is specifically included, and none of the object instances to be included in the variable-bindings of the notification are specifically excluded by the matching entries.

Each set of `snmpNotifyFilterTable` entries is divided into two collections of filter subtrees: the included filter subtrees, and the excluded filter subtrees. The `snmpNotifyFilterType` object defines the collection to which each matching entry belongs.

To determine whether a particular notification name or object instance is excluded by the set of matching entries, compare the

notification name's or object instance's OBJECT IDENTIFIER with each of the matching entries. For a notification name, if none match, then the notification name is considered excluded, and the notification should not be sent to this management target. For an object instance, if none match, the object instance is considered included, and the notification may be sent to this management target. If one or more match, then the notification name or object instance is included or excluded, according to the value of `snmpNotifyFilterType` in the entry whose value of `snmpNotifyFilterSubtree` has the most sub-identifiers. If multiple entries match and have the same number of sub-identifiers, then the value of `snmpNotifyFilterType`, in the entry among those which match, and whose instance is lexicographically the largest, determines the inclusion or exclusion.

A notification name or object instance's OBJECT IDENTIFIER X matches an entry in the `snmpNotifyFilterTable` when the number of sub-identifiers in X is at least as many as in the value of `snmpNotifyFilterSubtree` for the entry, and each sub-identifier in the value of `snmpNotifyFilterSubtree` matches its corresponding sub-identifier in X. Two sub-identifiers match either if the corresponding bit of `snmpNotifyFilterMask` is zero (the 'wild card' value), or if the two sub-identifiers are equal.

7. Management Target Translation in Proxy Forwarder Applications

This section describes the mechanisms used by a proxy forwarder application when using the MIB module described in this document to translate incoming management target information into outgoing management target information for the purpose of forwarding messages. There are actually two mechanisms a proxy forwarder may use, one for forwarding request messages, and one for forwarding notification messages.

7.1. Management Target Translation for Request Forwarding

When forwarding request messages, the proxy forwarder will select a single entry in the `snmpProxyTable`. To select this entry, it will perform the following comparisons:

- The `snmpProxyType` must be `read(1)` if the request is a Read-Class PDU. The `snmpProxyType` must be `write(2)` if the request is a Write-Class PDU.
- The `contextEngineID` must equal the `snmpProxyContextEngineID` object.
- If the `snmpProxyContextName` object is supported, it must equal the `contextName`.

- The `snmpProxyTargetParamsIn` object identifies an entry in the `snmpTargetParamsTable`. The `messageProcessingModel`, `security model`, `securityName`, and `securityLevel` must match the values of `snmpTargetParamsMPModel`, `snmpTargetParamsSecurityModel`, `snmpTargetParamsSecurityName`, and `snmpTargetParamsSecurityLevel` of the identified entry in the `snmpTargetParamsTable`.

There may be multiple entries in the `snmpProxyTable` for which these comparisons succeed. The entry whose `snmpProxyName` has the lexicographically smallest value and for which the comparisons succeed will be selected by the proxy forwarder.

The outgoing management target information is identified by the value of the `snmpProxySingleTargetOut` object of the selected entry. This object identifies an entry in the `snmpTargetAddrTable`. The identified entry in the `snmpTargetAddrTable` also contains a reference to the `snmpTargetParamsTable` (`snmpTargetAddrParams`). If either the identified entry in the `snmpTargetAddrTable` does not exist, or the identified entry in the `snmpTargetParamsTable` does not exist, then this `snmpProxyEntry` does not identify valid forwarding information, and the proxy forwarder should attempt to identify another row.

If there is no entry in the `snmpProxyTable` for which all of the conditions above may be met, then there is no appropriate forwarding information, and the proxy forwarder should take appropriate actions.

Otherwise, The `snmpTargetAddrTDomain`, `snmpTargetAddrTAddress`, `snmpTargetAddrTimeout`, and `snmpTargetRetryCount` of the identified `snmpTargetAddrEntry`, and the `snmpTargetParamsMPModel`, `snmpTargetParamsSecurityModel`, `snmpTargetParamsSecurityName`, and `snmpTargetParamsSecurityLevel` of the identified `snmpTargetParamsEntry` are used as the destination management target.

7.2. Management Target Translation for Notification Forwarding

When forwarding notification messages, the proxy forwarder will select multiple entries in the `snmpProxyTable`. To select these entries, it will perform the following comparisons:

- The `snmpProxyType` must be `trap(3)` if the notification is an Unconfirmed-Class PDU. The `snmpProxyType` must be `inform(4)` if the request is a Confirmed-Class PDU.
- The `contextEngineID` must equal the `snmpProxyContextEngineID` object.
- If the `snmpProxyContextName` object is supported, it must equal the `contextName`.

- The `snmpProxyTargetParamsIn` object identifies an entry in the `snmpTargetParamsTable`. The `messageProcessingModel`, `securityModel`, `securityName`, and `securityLevel` must match the values of `snmpTargetParamsMPPModel`, `snmpTargetParamsSecurityModel`, `snmpTargetParamsSecurityName`, and `snmpTargetParamsSecurityLevel` of the identified entry in the `snmpTargetParamsTable`.

All entries for which these conditions are met are selected. The `snmpProxyMultipleTargetOut` object of each such entry is used to select a set of entries in the `snmpTargetAddrTable`. Any `snmpTargetAddrEntry` whose `snmpTargetAddrTagList` object contains a tag value equal to the value of `snmpProxyMultipleTargetOut`, and whose `snmpTargetAddrParams` object references an existing entry in the `snmpTargetParamsTable`, is selected as a destination for the forwarded notification.

8. Intellectual Property

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10. Security Considerations

The SNMP applications described in this document typically have direct access to MIB instrumentation. Thus, it is very important that these applications be strict in their application of access control as described in this document.

In addition, there may be some types of notification generator applications which, rather than accessing MIB instrumentation using access control, will obtain MIB information through other means (such as from a command line). The implementors and users of such applications must be responsible for not divulging MIB information that normally would be inaccessible due to access control.

Finally, the MIBs described in this document contain potentially sensitive information. A security administrator may wish to limit access to these MIBs.

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Appendix A - Trap Configuration Example

This section describes an example configuration for a Notification Generator application which implements the `snmpNotifyBasicCompliance` level. The example configuration specifies that the Notification Generator should send notifications to 3 separate managers, using authentication and no privacy for the first 2 managers, and using both authentication and privacy for the third manager.

The configuration consists of three rows in the `snmpTargetAddrTable`, two rows in the `snmpTargetTable`, and two rows in the `snmpNotifyTable`.

```
* snmpTargetAddrName      = "addr1"
  snmpTargetAddrTDomain   = snmpUDPDomain
  snmpTargetAddrTAddress  = 128.1.2.3/162
  snmpTargetAddrTagList   = "group1"
  snmpTargetAddrParams    = "AuthNoPriv-joe"
  snmpTargetAddrStorageType = readOnly(5)
  snmpTargetAddrRowStatus = active(1)

* snmpTargetAddrName      = "addr2"
  snmpTargetAddrTDomain   = snmpUDPDomain
  snmpTargetAddrTAddress  = 128.2.4.6/162
  snmpTargetAddrTagList   = "group1"
  snmpTargetAddrParams    = "AuthNoPriv-joe"
  snmpTargetAddrStorageType = readOnly(5)
  snmpTargetAddrRowStatus = active(1)

* snmpTargetAddrName      = "addr3"
  snmpTargetAddrTDomain   = snmpUDPDomain
  snmpTargetAddrTAddress  = 128.1.5.9/162
  snmpTargetAddrTagList   = "group2"
  snmpTargetAddrParams    = "AuthPriv-bob"
  snmpTargetAddrStorageType = readOnly(5)
  snmpTargetAddrRowStatus = active(1)

* snmpTargetParamsName    = "AuthNoPriv-joe"
  snmpTargetParamsMPModel = 3
  snmpTargetParamsSecurityModel = 3 (USM)
  snmpTargetParamsSecurityName = "joe"
  snmpTargetParamsSecurityLevel = authNoPriv(2)
  snmpTargetParamsStorageType = readOnly(5)
  snmpTargetParamsRowStatus = active(1)
```

```

* snmpTargetParamsName           = "AuthPriv-bob"
  snmpTargetParamsMPModel        = 3
  snmpTargetParamsSecurityModel  = 3 (USM)
  snmpTargetParamsSecurityName   = "bob"
  snmpTargetParamsSecurityLevel  = authPriv(3)
  snmpTargetParamsStorageType    = readOnly(5)
  snmpTargetParamsRowStatus      = active(1)

* snmpNotifyName                 = "group1"
  snmpNotifyTag                  = "group1"
  snmpNotifyType                 = trap(1)
  snmpNotifyStorageType          = readOnly(5)
  snmpNotifyRowStatus            = active(1)

* snmpNotifyName                 = "group2"
  snmpNotifyTag                  = "group2"
  snmpNotifyType                 = trap(1)
  snmpNotifyStorageType          = readOnly(5)
  snmpNotifyRowStatus            = active(1)

```

These entries define two groups of management targets. The first group contains two management targets:

	first target -----	second target -----
messageProcessingModel	SNMPv3	SNMPv3
securityModel	3 (USM)	3 (USM)
securityName	"joe"	"joe"
securityLevel	authNoPriv(2)	authNoPriv(2)
transportDomain	snmpUDPDomain	snmpUDPDomain
transportAddress	128.1.2.3/162	128.2.4.6/162

And the second group contains a single management target:

```

messageProcessingModel  SNMPv3
securityLevel          authPriv(3)
securityModel          3 (USM)
securityName           "bob"
transportDomain        snmpUDPDomain
transportAddress       128.1.5.9/162

```

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