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Definitions of Managed Objects for the Delegation of Management Scripts

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.

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Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes a set of managed objects that allow the delegation of management scripts to distributed managers.

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1. Introduction

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes a set of managed objects that allow the delegation of management scripts to distributed managers.

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

2. The SNMP Management Framework

The SNMP Management Framework presently consists of five major components:

- o An overall architecture, described in RFC 2571 [RFC2571].
- o Mechanisms for describing and naming objects and events for the purpose of management. The first version of this Structure of Management Information (SMI) is called SMIV1 and described in STD 16, RFC 1155 [RFC1155], STD 16, RFC 1212 [RFC1212] and RFC 1215 [RFC1215]. The second version, called SMIV2, is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].
- o Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and described in STD 15, RFC 1157 [RFC1157]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in RFC 1901 [RFC1901] and RFC 1906 [RFC1906]. The third version of the message protocol is called SNMPv3 and described in RFC 1906 [RFC1906], RFC 2572 [RFC2572] and RFC 2574 [RFC2574].
- o Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in STD 15, RFC 1157 [RFC1157]. A second set of protocol operations and associated PDU formats is described in RFC 1905 [RFC1905].
- o A set of fundamental applications described in RFC 2573 [RFC2573] and the view-based access control mechanism described in RFC 2575 [RFC2575].

A more detailed introduction to the current SNMP Management Framework can be found in RFC 2570 [RFC2570].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the mechanisms defined in the SMI.

This memo specifies a MIB module that is compliant to the SMIV2. A MIB conforming to the SMIV1 can be produced through the appropriate translations. The resulting translated MIB must be semantically equivalent, except where objects or events are omitted because no translation is possible (use of Counter64). Some machine readable information in SMIV2 will be converted into textual descriptions in SMIV1 during the translation process. However, this loss of machine readable information is not considered to change the semantics of the MIB.

3. Overview

The Script MIB module defined in this memo can be used to delegate management functions to distributed managers. Management functions are defined as management scripts written in a management scripting language. This MIB makes no assumptions about the language itself and even allows distribution of compiled native code, if an implementation is able to execute native code under the control of this MIB.

The Script MIB defines a standard interface for the delegation of management functions based on the Internet management framework. In particular, it provides the following capabilities:

1. Capabilities to transfer management scripts to a distributed manager.
2. Capabilities for initiating, suspending, resuming and terminating management scripts.
3. Capabilities to transfer arguments for management scripts.
4. Capabilities to monitor and control running management scripts.
5. Capabilities to transfer the results produced by running management scripts.

This memo does not address any additional topics like the generation of notifications or how to address remote agents from a Script MIB implementation.

3.1. Terms

This section defines the terms used throughout this memo.

- o A 'distributed manager' is a processing entity which is capable of performing network management functions. For the scope of this memo, a distributed manager is assumed to implement the Script MIB.
- o A 'higher-level manager', or just 'manager', is a processing entity or human who initiates and controls the operations performed by one or more distributed managers.
- o A 'management script' is a set of instructions written in an executable language which implements a management function.
- o A 'management scripting language' is a language used to write management scripts. The term scripting language does not imply that the language must have the characteristics of scripting languages (e.g., string orientation, interpretation, weak typing). The MIB defined in this memo also allows to control management scripts written in arbitrary compiled system programming languages.
- o A 'distributed manager' can be decomposed into an 'SNMP entity' which implements the Script MIB defined in this memo and the 'runtime system' that executes scripts. The Script MIB sees the runtime system as the managed resource which is controlled by the MIB.

The runtime system can act as an SNMP application, according to the SNMP architecture defined in RFC 2571 [RFC2571]. For example, a runtime system which sends SNMP requests to other SNMP entities will act as a command generator application. The SNMP applications in the runtime system may use the same SNMP engine which also serves the command responder application used to implement the Script MIB, but they are not required to do so.

- o A 'launch button' is the conceptual button used to start the execution of a management script. It assigns control parameters to a management script. In particular, it defines the ownership of the scripts started from a launch button. The ownership can be used by the language runtime system to enforce security profiles on a running management script.

4. Requirements and Design Issues

This section discusses some general requirements that have influenced the design of the Script MIB.

- o The Script MIB must not make any assumptions about specific languages or runtime systems.
- o The Script MIB must provide mechanisms that help to avoid new management problems (e.g., script version problems).
- o The Script MIB must provide SNMP interfaces to all functions required to delegate management scripts. However, other protocols might be used in addition if they provide a significant improvement in terms of convenience for implementation or performance.
- o The Script MIB must be organized so that access can be controlled effectively by using view-based access control [RFC2575].

The following sections discuss some design issues in more detail.

4.1. Script Languages

The Script MIB defined in this memo makes no assumption about the script language. This MIB can therefore be used in combination with different languages (such as Tcl or Java) and/or different versions of the same language. No assumptions are made about the format in which management scripts are transferred.

The Script MIB provides access to information about the language versions supported by a Script MIB implementation so that a manager can learn about the capabilities provided by an implementation. Languages and language versions are identified as follows:

1. The language is identified by an object identifier. Object identifier for well-known languages will be registered by the Internet Assigned Numbers Authority (IANA). Enterprise specific languages can also be registered in the enterprise specific OID subtree.
2. A particular version of a language is identified by a language version number. The combination of a language object identifier and a language version is in most cases sufficient to decide whether a script can be executed or not.

3. Different implementations of the same language version might have differences due to ambiguities in the language definition or additional language features provided by an implementor. An additional object identifier value is provided which identifies the organization which provides the implementation of a language. This might be used by scripts that require a particular implementation of a language.
4. Finally, there might be different versions of a language implementation. A version number for the language implementation is provided so that the manager can also distinguish between different implementations from the same organization of a particular language version.

The version numbers can either be used by a manager to select the language version required to execute a particular script or to select a script that fits the language versions supported by a particular Script MIB implementation.

An additional table lists language extensions that provide features not provided by the core language. Language extensions are usually required to turn a general purpose language into a management language. In many cases, language extensions will come in the form of libraries that provide capabilities like sending SNMP requests to remote SNMP agents or accessing the local MIB instrumentation. Every extension is associated with a language and carries its own version numbers.

4.2. Script Transfer

There are two different ways to transfer management scripts to a distributed manager. The first approach requires that the manager pushes the script to the distributed manager. This is therefore called the 'push model'. The second approach is the 'pull model' where the manager tells the distributed manager the location of the script and the distributed manager retrieves the script itself.

The MIB defined in this memo supports both models. The 'push model' is realized by a table which allows a manager to write scripts by sending a sequence of SNMP set requests. The script can be split into several fragments in order to deal with SNMP message size limitations.

The 'pull model' is realized by the use of Uniform Resource Locators (URLs) [RFC2396] that point to the script source. The manager writes the URL which points to the script source to the distributed manager

by sending an SNMP set request. The distributed manager is then responsible for retrieving the document using the protocol specified in the URL. This allows the use of protocols like FTP [RFC959] or HTTP [RFC2616] to transfer large management scripts efficiently.

The Script MIB also allows management scripts that are hard-wired into the Script MIB implementation. Built-in scripts can either be implemented in a language runtime system, or they can be built natively into the Script MIB implementation. The implementation of the 'push model' or the 'pull model' is not required.

Scripts can be stored in non-volatile storage. This allows a distributed manager to restart scripts if it is restarted (off-line restart). A manager is not required to push scripts back into the distributed manager after a restart if the script is backed up in non-volatile storage.

Every script is identified by an administratively assigned name. This name may be used to derive the name which is used to access the script in non-volatile storage. This mapping is implementation specific. However, the mapping must ensure that the Script MIB implementation can handle scripts with the same administrative name owned by different managers. One way to achieve this is to use the script owner in addition to the script name in order to derive the internal name used to refer to a particular script in non-volatile storage.

4.3. Script Execution

The Script MIB permits execution of several instances of the same or different management scripts. Script arguments are passed as OCTET STRING values. Scripts return a single result value which is also an OCTET STRING value. The semantic interpretation of result values is left to the invoking manager or other management scripts. A script invoker must understand the format and semantics of both the arguments and the results of the scripts that it invokes.

Scripts can also export complex results through a MIB interface. This allows a management application to access and use script results in the same manner as it processes any other MIB data. However, the Script MIB does not provide any special support for the implementation of MIBs through scripts.

Runtime errors terminate active scripts. An exit code and a human readable error message is left in the MIB. A notification containing the exit code, the error message and a timestamp is generated when a script terminates with an error exit code.

Script arguments and results do not have any size limitations other than the limits imposed by the SMI and the SNMP protocol. However, implementations of this MIB might have further restrictions. A script designer might therefore choose to return the results via other mechanisms if the script results can be very large. One possibility is to return a URL as a script result which points to the file containing the script output.

Executing scripts have a status object attached which allows script execution to be suspended, resumed, or aborted. The precise semantics of the suspend and resume operations are language and runtime system dependent. Some runtime systems may choose to not implement the suspend/resume operations.

A history of finished scripts is kept in the MIB. A script invoker can collect results at a later point in time (offline operation). Control objects can be used to control how entries in the history are aged out if the table fills up.

5. Structure of the MIB

This section presents the structure of the MIB. The objects are arranged into the following groups:

- o language group (smLangTable, smExtsnTable)
- o script group (smScriptTable)
- o script code group (smCodeTable)
- o script launch group (smLaunchTable)
- o running script group (smRunTable)

5.1. Language Group

The smLanguageGroup is used to provide information about the languages and the language extensions supported by a Script MIB implementation. This group includes two tables. The smLangTable lists all languages supported by a Script MIB implementation and the smExtsnTable lists the extensions that are available for a given language.

5.2. Script Group

The smScriptGroup consists of a single table, called the smScriptTable. The smScriptTable lists all scripts known to a Script MIB implementation. The smScriptTable contains objects that allow the following operations:

- o download scripts from a URL (pull model)
- o read scripts from local non-volatile storage
- o store scripts in local non-volatile storage
- o delete scripts from local non-volatile storage
- o list permanent scripts (that can not be changed or removed)
- o read and modify the script status (enabled, disabled, editing)

A status object called smScriptOperStatus allows a manager to obtain the current status of a script. It is also used to provide an error indication if an attempt to invoke one of the operations listed above fails. The status change of a script can be requested by modifying the associated smScriptAdminStatus object.

The source of a script is defined by the smScriptSource object. This object may contain a URL pointing to a remote location which provides access to the management script. The script source is read from the smCodeTable (described below) or from non-volatile storage if the smScriptSource object contains an empty URL. The smScriptStorageType object is used to distinguish between scripts read from non-volatile storage and scripts read from the smCodeTable.

Scripts are automatically loaded once the smScriptAdminStatus object is set to 'enabled'. Loading a script includes retrieving the script (probably from a remote location), compiling the script for languages that require a compilation step, and making the code available to the runtime system. The smScriptOperStatus object is used to indicate the status of the loading process. This object will start in the state 'retrieving', switch to the state 'compiling' and finally reach the state 'enabled'. Errors during the retrieval or compilation phase will result in an error state such as 'compilationFailed'.

5.3. Code Group

The smCodeGroup consists of a single table, called the smCodeTable, which provides the ability to transfer and modify scripts via SNMP set requests. In particular, the smCodeTable allows the following operations:

- o download scripts via SNMP (push model)
- o modify scripts via SNMP (editing)

The smCodeTable lists the code of a script. A script can be fragmented over multiple rows of the smCodeTable in order to handle SNMP message size limitations. Modifications of the smCodeTable are only possible if the associated smScriptOperStatus object has the value 'editing'. The Script MIB implementation reloads the modified script code once the smScriptOperStatus changes to 'enabled' again.

The implementation of the smCodeGroup is optional.

5.4. Launch Group

The smLaunchGroup contains a single table, the smLaunchTable. An entry in the smLaunchTable represents a launch button which can be used to start a script. The smLaunchTable allows the following operations:

- o associate a script with an owner used during script execution
- o provide arguments and parameters for script invocation
- o invoke scripts with a single set operation

The smLaunchTable describes scripts and their parameters that are ready to be launched. An entry in the smLaunchTable attaches an argument to a script and control values which, for example, define the maximum number of times that a script invoked from a particular row in the smLaunchTable may be running concurrently.

An entry in the smLaunchTable also defines the owner which will be used to associate permissions with the script execution.

5.5. Run Group

The smRunGroup contains a single table, called the smRunTable, which lists all scripts that are currently running or have terminated recently. The smRunTable contains objects that allow the following operations:

- o retrieve status information from running scripts
- o control running scripts (suspend, resume, abort)
- o retrieve results from recently terminated scripts
- o control the remaining maximum lifetime of a running script
- o control how long script results are accessible

Every row in the smRunTable contains the argument passed during script invocation, the result produced by the script and the script exit code. The smRunTable also provides information about the current run state as well as start and end time-stamps. There are three writable objects in the smRunTable. The smRunLifeTime object defines the maximum time a running script may run before it is terminated by the Script MIB implementation. The smRunExpireTime object defines the time that a completed script can stay in the smRunTable before it is aged out. The smRunControl object allows running scripts to be suspended, resumed, or aborted.

6. Definitions

```
DISMAN-SCRIPT-MIB DEFINITIONS ::= BEGIN
```

```
IMPORTS
```

```
    MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,  
    Integer32, Unsigned32, mib-2  
    FROM SNMPv2-SMI
```

```
    RowStatus, TimeInterval, DateAndTime, StorageType, DisplayString  
    FROM SNMPv2-TC
```

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

```
    SnmpAdminString  
    FROM SNMP-FRAMEWORK-MIB;
```

```
scriptMIB MODULE-IDENTITY
```

```
    LAST-UPDATED "200108210000Z"
```

```
    ORGANIZATION "IETF Distributed Management Working Group"
```

```
    CONTACT-INFO
```

```
        "WG EMail:  disman@dorothy.bmc.com
```

```
        Subscribe:  disman-request@dorothy.bmc.com
```

```
        Chair:      Randy Presuhn  
                   BMC Software, Inc.
```

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DESCRIPTION

"This MIB module defines a set of objects that allow to delegate management scripts to distributed managers."

REVISION "200108210000Z"

DESCRIPTION

"Revised version, published as RFC 3165.

This revision introduces several new objects: smScriptError, smScriptLastChange, smLaunchError, smLaunchLastChange, smLaunchRowExpireTime, smRunResultTime, and smRunErrorTime.

The following existing objects were updated: the maximum value of smRunLifeTime now disables the timer, an autostart value was added to the smLaunchAdminStatus object, and a new expired state was added to the smLaunchOperStatus object.

A new smScriptException notification has been added to support runtime error notifications.

Created new conformance and compliance statements that take care of the new objects and notifications.

Clarifications have been added in several places to remove ambiguities or contradictions that were discovered and reported by implementors."

```

    REVISION      "199902221800Z"
    DESCRIPTION
        "Initial version, published as RFC 2592."
    ::= { mib-2 64 }

--
-- The groups defined within this MIB module:
--

smObjects      OBJECT IDENTIFIER ::= { scriptMIB 1 }
smNotifications OBJECT IDENTIFIER ::= { scriptMIB 2 }
smConformance  OBJECT IDENTIFIER ::= { scriptMIB 3 }

--
-- Script language and language extensions.
--
-- This group defines tables which list the languages and the
-- language extensions supported by a Script MIB implementation.
-- Languages are uniquely identified by object identifier values.
--

smLangTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF SmLangEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "This table lists supported script languages."
    ::= { smObjects 1 }

smLangEntry OBJECT-TYPE
    SYNTAX      SmLangEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "An entry describing a particular language."
    INDEX { smLangIndex }
    ::= { smLangTable 1 }

SmLangEntry ::= SEQUENCE {
    smLangIndex      Integer32,
    smLangLanguage    OBJECT IDENTIFIER,
    smLangVersion     SnmpAdminString,
    smLangVendor      OBJECT IDENTIFIER,
    smLangRevision    SnmpAdminString,
    smLangDescr       SnmpAdminString
}

smLangIndex OBJECT-TYPE
```

SYNTAX Integer32 (1..2147483647)
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION

"The locally arbitrary, but unique identifier associated with this language entry.

The value is expected to remain constant at least from one re-initialization of the entity's network management system to the next re-initialization.

Note that the data type and the range of this object must be consistent with the definition of smScriptLanguage."

::= { smLangEntry 1 }

smLangLanguage OBJECT-TYPE

SYNTAX OBJECT IDENTIFIER
MAX-ACCESS read-only
STATUS current
DESCRIPTION

"The globally unique identification of the language."

::= { smLangEntry 2 }

smLangVersion OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE (0..32))
MAX-ACCESS read-only
STATUS current
DESCRIPTION

"The version number of the language. The zero-length string shall be used if the language does not have a version number.

It is suggested that the version number consist of one or more decimal numbers separated by dots, where the first number is called the major version number."

::= { smLangEntry 3 }

smLangVendor OBJECT-TYPE

SYNTAX OBJECT IDENTIFIER
MAX-ACCESS read-only
STATUS current
DESCRIPTION

"An object identifier which identifies the vendor who provides the implementation of the language. This object identifier SHALL point to the object identifier directly below the enterprise object identifier {1 3 6 1 4 1} allocated for the vendor. The value must be the object identifier {0 0} if the vendor is not known."

```
::= { smLangEntry 4 }
```

smLangRevision OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE (0..32))

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The version number of the language implementation.
The value of this object must be an empty string if
version number of the implementation is unknown."

It is suggested that the value consist of one or more
decimal numbers separated by dots, where the first
number is called the major version number."

```
::= { smLangEntry 5 }
```

smLangDescr OBJECT-TYPE

SYNTAX SnmpAdminString

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A textual description of the language."

```
::= { smLangEntry 6 }
```

smExtsnTable OBJECT-TYPE

SYNTAX SEQUENCE OF SmExtsnEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table lists supported language extensions."

```
::= { smObjects 2 }
```

smExtsnEntry OBJECT-TYPE

SYNTAX SmExtsnEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry describing a particular language extension."

INDEX { smLangIndex, smExtsnIndex }

```
::= { smExtsnTable 1 }
```

SmExtsnEntry ::= SEQUENCE {

smExtsnIndex Integer32,

smExtsnExtension OBJECT IDENTIFIER,

smExtsnVersion SnmpAdminString,

smExtsnVendor OBJECT IDENTIFIER,

smExtsnRevision SnmpAdminString,

```
    smExtsnDescr          SmpAdminString
  }

smExtsnIndex OBJECT-TYPE
    SYNTAX          Integer32 (1..2147483647)
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "The locally arbitrary, but unique identifier associated
         with this language extension entry.

         The value is expected to remain constant at least from one
         re-initialization of the entity's network management system
         to the next re-initialization."
    ::= { smExtsnEntry 1}

smExtsnExtension OBJECT-TYPE
    SYNTAX          OBJECT IDENTIFIER
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The globally unique identification of the language
         extension."
    ::= { smExtsnEntry 2 }

smExtsnVersion OBJECT-TYPE
    SYNTAX          SmpAdminString (SIZE (0..32))
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The version number of the language extension.
         It is suggested that the version number consist of one or
         more decimal numbers separated by dots, where the first
         number is called the major version number."
    ::= { smExtsnEntry 3 }

smExtsnVendor OBJECT-TYPE
    SYNTAX          OBJECT IDENTIFIER
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "An object identifier which identifies the vendor who
         provides the implementation of the extension. The
         object identifier value should point to the OID node
         directly below the enterprise OID {1 3 6 1 4 1}
         allocated for the vendor. The value must be the object
         identifier {0 0} if the vendor is not known."
    ::= { smExtsnEntry 4 }
```

```
smExtsnRevision OBJECT-TYPE
    SYNTAX      SnmpAdminString (SIZE (0..32))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The version number of the extension implementation.
        The value of this object must be an empty string if
        version number of the implementation is unknown.

        It is suggested that the value consist of one or more
        decimal numbers separated by dots, where the first
        number is called the major version number."
    ::= { smExtsnEntry 5 }

smExtsnDescr OBJECT-TYPE
    SYNTAX      SnmpAdminString
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "A textual description of the language extension."
    ::= { smExtsnEntry 6 }

--
-- Scripts known by the Script MIB implementation.
--
-- This group defines a table which lists all known scripts.
-- Scripts can be added and removed through manipulation of the
-- smScriptTable.
--

smScriptObjects OBJECT IDENTIFIER ::= { smObjects 3 }

smScriptTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF SmScriptEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "This table lists and describes locally known scripts."
    ::= { smScriptObjects 1 }

smScriptEntry OBJECT-TYPE
    SYNTAX      SmScriptEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "An entry describing a particular script. Every script that
        is stored in non-volatile memory is required to appear in
        this script table."
```

```

INDEX { smScriptOwner, smScriptName }
 ::= { smScriptTable 1 }

```

```

SmScriptEntry ::= SEQUENCE {
    smScriptOwner      SnmpAdminString,
    smScriptName       SnmpAdminString,
    smScriptDescr      SnmpAdminString,
    smScriptLanguage   Integer32,
    smScriptSource     DisplayString,
    smScriptAdminStatus INTEGER,
    smScriptOperStatus INTEGER,
    smScriptStorageType StorageType,
    smScriptRowStatus  RowStatus,
    smScriptError       SnmpAdminString,
    smScriptLastChange  DateAndTime
}

```

```

smScriptOwner OBJECT-TYPE
    SYNTAX      SnmpAdminString (SIZE (0..32))
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The manager who owns this row in the smScriptTable."
    ::= { smScriptEntry 1 }

```

```

smScriptName OBJECT-TYPE
    SYNTAX      SnmpAdminString (SIZE (1..32))
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The locally-unique, administratively assigned name for this
        script. This object allows an smScriptOwner to have multiple
        entries in the smScriptTable.

        This value of this object may be used to derive the name
        (e.g. a file name) which is used by the Script MIB
        implementation to access the script in non-volatile
        storage. The details of this mapping are implementation
        specific. However, the mapping needs to ensure that scripts
        created by different owners with the same script name do not
        map to the same name in non-volatile storage."
    ::= { smScriptEntry 2 }

```

```

smScriptDescr OBJECT-TYPE
    SYNTAX      SnmpAdminString
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION

```

"A description of the purpose of the script."
::= { smScriptEntry 3 }

smScriptLanguage OBJECT-TYPE

SYNTAX Integer32 (0..2147483647)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of this object type identifies an entry in the smLangTable which is used to execute this script. The special value 0 may be used by hard-wired scripts that can not be modified and that are executed by internal functions.

Set requests to change this object are invalid if the value of smScriptOperStatus is 'enabled' or 'compiling' and will result in an inconsistentValue error.

Note that the data type and the range of this object must be consistent with the definition of smLangIndex."

::= { smScriptEntry 4 }

smScriptSource OBJECT-TYPE

SYNTAX DisplayString

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object either contains a reference to the script source or an empty string. A reference must be given in the form of a Uniform Resource Locator (URL) as defined in RFC 2396. The allowed character sets and the encoding rules defined in RFC 2396 section 2 apply.

When the smScriptAdminStatus object is set to 'enabled', the Script MIB implementation will 'pull' the script source from the URL contained in this object if the URL is not empty.

An empty URL indicates that the script source is loaded from local storage. The script is read from the smCodeTable if the value of smScriptStorageType is volatile. Otherwise, the script is read from non-volatile storage.

Note: This document does not mandate implementation of any specific URL scheme. An attempt to load a script from a nonsupported URL scheme will cause the smScriptOperStatus to report an 'unknownProtocol' error.

Set requests to change this object are invalid if the value of smScriptOperStatus is 'enabled', 'editing', 'retrieving' or 'compiling' and will result in an inconsistentValue error."

```
DEFVAL { ''H }
::= { smScriptEntry 5 }
```

smScriptAdminStatus OBJECT-TYPE

```
SYNTAX      INTEGER {
                enabled(1),
                disabled(2),
                editing(3)
            }
```

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of this object indicates the desired status of the script. See the definition of smScriptOperStatus for a description of the values.

When the smScriptAdminStatus object is set to 'enabled' and the smScriptOperStatus is 'disabled' or one of the error states, the Script MIB implementation will 'pull' the script source from the URL contained in the smScriptSource object if the URL is not empty."

```
DEFVAL { disabled }
::= { smScriptEntry 6 }
```

smScriptOperStatus OBJECT-TYPE

```
SYNTAX      INTEGER {
                enabled(1),
                disabled(2),
                editing(3),
                retrieving(4),
                compiling(5),
                noSuchScript(6),
                accessDenied(7),
                wrongLanguage(8),
                wrongVersion(9),
                compilationFailed(10),
                noResourcesLeft(11),
                unknownProtocol(12),
                protocolFailure(13),
                genericError(14)
            }
```

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The actual status of the script in the runtime system. The value of this object is only meaningful when the value of the smScriptRowStatus object is 'active'.

The smScriptOperStatus object may have the following values:

- 'enabled' indicates that the script is available and can be started by a launch table entry.
- 'disabled' indicates that the script can not be used.
- 'editing' indicates that the script can be modified in the smCodeTable.
- 'retrieving' indicates that the script is currently being loaded from non-volatile storage or a remote system.
- 'compiling' indicates that the script is currently being compiled by the runtime system.
- 'noSuchScript' indicates that the script does not exist at the smScriptSource.
- 'accessDenied' indicates that the script can not be loaded from the smScriptSource due to a lack of permissions.
- 'wrongLanguage' indicates that the script can not be loaded from the smScriptSource because of a language mismatch.
- 'wrongVersion' indicates that the script can not be loaded from the smScriptSource because of a language version mismatch.
- 'compilationFailed' indicates that the compilation failed.
- 'noResourcesLeft' indicates that the runtime system does not have enough resources to load the script.
- 'unknownProtocol' indicates that the script could not be loaded from the smScriptSource because the requested protocol is not supported.
- 'protocolFailure' indicates that the script could not be loaded from the smScriptSource because of a protocol failure.
- 'genericError' indicates that the script could not be

loaded due to an error condition not listed above.

The 'retrieving' and 'compiling' states are transient states which will either lead to one of the error states or the 'enabled' state. The 'disabled' and 'editing' states are administrative states which are only reached by explicit management operations.

All launch table entries that refer to this script table entry shall have an smLaunchOperStatus value of 'disabled' when the value of this object is not 'enabled'."

```
DEFVAL { disabled }
::= { smScriptEntry 7 }
```

smScriptStorageType OBJECT-TYPE

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

"This object defines whether this row and the script controlled by this row are kept in volatile storage and lost upon reboot or if this row is backed up by non-volatile or permanent storage.

The storage type of this row always complies with the value of this entry if the value of the corresponding RowStatus object is 'active'.

However, the storage type of the script controlled by this row may be different, if the value of this entry is 'non-volatile'. The script controlled by this row is written into local non-volatile storage if the following condition becomes true:

- (a) the URL contained in the smScriptSource object is empty and
- (b) the smScriptStorageType is 'nonVolatile' and
- (c) the smScriptOperStatus is 'enabled'

Setting this object to 'volatile' removes a script from non-volatile storage if the script controlled by this row has been in non-volatile storage before. Attempts to set this object to permanent will always fail with an inconsistentValue error.

The value of smScriptStorageType is only meaningful if the value of the corresponding RowStatus object is 'active'.

If smScriptStorageType has the value permanent(4), then all objects whose MAX-ACCESS value is read-create must be writable, with the exception of the smScriptStorageType and smScriptRowStatus objects, which shall be read-only."

```
DEFVAL { volatile }
::= { smScriptEntry 8 }
```

smScriptRowStatus OBJECT-TYPE

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

"A control that allows entries to be added and removed from this table.

Changing the smScriptRowStatus from 'active' to 'notInService' will remove the associated script from the runtime system.

Deleting conceptual rows from this table may affect the deletion of other resources associated with this row. For example, a script stored in non-volatile storage may be removed from non-volatile storage.

An entry may not exist in the 'active' state unless all required objects in the entry have appropriate values. Rows that are not complete or not in service are not known by the script runtime system.

Attempts to 'destroy' a row or to set a row 'notInService' while the smScriptOperStatus is 'enabled' will result in an inconsistentValue error.

Attempts to 'destroy' a row or to set a row 'notInService' where the value of the smScriptStorageType object is 'permanent' or 'readOnly' will result in an inconsistentValue error.

The value of this object has no effect on whether other objects in this conceptual row can be modified."

```
::= { smScriptEntry 9 }
```

smScriptError OBJECT-TYPE

```
SYNTAX      SnmpAdminString
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
```

"This object contains a descriptive error message if the

transition into the operational status 'enabled' failed.
 Implementations must reset the error message to a
 zero-length string when a new attempt to change the
 script status to 'enabled' is started."

```
DEFVAL { ''H }
::= { smScriptEntry 10 }
```

smScriptLastChange OBJECT-TYPE

```
SYNTAX      DateAndTime
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
```

"The date and time when this script table entry was last
 modified. The value '0000000000000000'H is returned if
 the script table entry has not yet been modified.

Note that the resetting of smScriptError is not considered
 a change of the script table entry."

```
DEFVAL { '0000000000000000'H }
::= { smScriptEntry 11 }
```

--

-- Access to script code via SNMP

--

-- The smCodeTable allows script code to be read and modified
 -- via SNMP.

--

smCodeTable OBJECT-TYPE

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

"This table contains the script code for scripts that are
 written via SNMP write operations."

```
::= { smScriptObjects 2 }
```

smCodeEntry OBJECT-TYPE

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

"An entry describing a particular fragment of a script."

```
INDEX { smScriptOwner, smScriptName, smCodeIndex }
::= { smCodeTable 1 }
```

```
SmCodeEntry ::= SEQUENCE {
    smCodeIndex      Unsigned32,
```

```
    smCodeText      OCTET STRING,
    smCodeRowStatus  RowStatus
}

smCodeIndex OBJECT-TYPE
    SYNTAX      Unsigned32 (1..4294967295)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The index value identifying this code fragment."
        ::= { smCodeEntry 1 }

smCodeText OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE (1..1024))
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The code that makes up a fragment of a script. The format
         of this code fragment depends on the script language which
         is identified by the associated smScriptLanguage object."
        ::= { smCodeEntry 2 }

smCodeRowStatus OBJECT-TYPE
    SYNTAX      RowStatus
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "A control that allows entries to be added and removed from
         this table.

         The value of this object has no effect on whether other
         objects in this conceptual row can be modified."
        ::= { smCodeEntry 3 }

--
-- Script execution.
--
-- This group defines tables which allow script execution to be
-- initiated, suspended, resumed, and terminated. It also provides
-- a mechanism for keeping a history of recent script executions
-- and their results.
--

smRunObjects OBJECT IDENTIFIER ::= { smObjects 4 }

smLaunchTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF SmLaunchEntry
    MAX-ACCESS  not-accessible
```

```

STATUS      current
DESCRIPTION
    "This table lists and describes scripts that are ready
    to be executed together with their parameters."
::= { smRunObjects 1 }

```

smLaunchEntry OBJECT-TYPE

```

SYNTAX      SmLaunchEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "An entry describing a particular executable script."
INDEX { smLaunchOwner, smLaunchName }
::= { smLaunchTable 1 }

```

SmLaunchEntry ::= SEQUENCE {

smLaunchOwner	SnmpAdminString,
smLaunchName	SnmpAdminString,
smLaunchScriptOwner	SnmpAdminString,
smLaunchScriptName	SnmpAdminString,
smLaunchArgument	OCTET STRING,
smLaunchMaxRunning	Unsigned32,
smLaunchMaxCompleted	Unsigned32,
smLaunchLifeTime	TimeInterval,
smLaunchExpireTime	TimeInterval,
smLaunchStart	Integer32,
smLaunchControl	INTEGER,
smLaunchAdminStatus	INTEGER,
smLaunchOperStatus	INTEGER,
smLaunchRunIndexNext	Integer32,
smLaunchStorageType	StorageType,
smLaunchRowStatus	RowStatus,
smLaunchError	SnmpAdminString,
smLaunchLastChange	DateAndTime,
smLaunchRowExpireTime	TimeInterval

```

}
```

smLaunchOwner OBJECT-TYPE

```

SYNTAX      SnmpAdminString (SIZE (0..32))
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION

```

```

    "The manager who owns this row in the smLaunchTable. Every
    instance of a running script started from a particular entry
    in the smLaunchTable (i.e. entries in the smRunTable) will
    be owned by the same smLaunchOwner used to index the entry
    in the smLaunchTable. This owner is not necessarily the same
    as the owner of the script itself (smLaunchScriptOwner)."
```

```
::= { smLaunchEntry 1 }
```

smLaunchName OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE (1..32))

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The locally-unique, administratively assigned name for this launch table entry. This object allows an smLaunchOwner to have multiple entries in the smLaunchTable. The smLaunchName is an arbitrary name that must be different from any other smLaunchTable entries with the same smLaunchOwner but can be the same as other entries in the smLaunchTable with different smLaunchOwner values. Note that the value of smLaunchName is not related in any way to the name of the script being launched."

```
::= { smLaunchEntry 2 }
```

smLaunchScriptOwner OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE (0..32))

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of this object in combination with the value of smLaunchScriptName identifies the script that can be launched from this smLaunchTable entry. Attempts to write this object will fail with an inconsistentValue error if the value of smLaunchOperStatus is 'enabled'."

```
::= { smLaunchEntry 3 }
```

smLaunchScriptName OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE (0..32))

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of this object in combination with the value of the smLaunchScriptOwner identifies the script that can be launched from this smLaunchTable entry. The zero-length string may be used to point to a non-existing script.

Attempts to write this object will fail with an inconsistentValue error if the value of smLaunchOperStatus is 'enabled'."

DEFVAL { ''H }

```
::= { smLaunchEntry 4 }
```

smLaunchArgument OBJECT-TYPE

SYNTAX OCTET STRING

MAX-ACCESS read-create
STATUS current
DESCRIPTION

"The argument supplied to the script. When a script is invoked, the value of this object is used to initialize the smRunArgument object."

DEFVAL { ''H }
::= { smLaunchEntry 5 }

smLaunchMaxRunning OBJECT-TYPE

SYNTAX Unsigned32 (1..4294967295)
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"The maximum number of concurrently running scripts that may be invoked from this entry in the smLaunchTable. Lowering the current value of this object does not affect any scripts that are already executing."

DEFVAL { 1 }
::= { smLaunchEntry 6 }

smLaunchMaxCompleted OBJECT-TYPE

SYNTAX Unsigned32 (1..4294967295)
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"The maximum number of finished scripts invoked from this entry in the smLaunchTable allowed to be retained in the smRunTable. Whenever the value of this object is changed and whenever a script terminates, entries in the smRunTable are deleted if necessary until the number of completed scripts is smaller than the value of this object. Scripts whose smRunEndTime value indicates the oldest completion time are deleted first."

DEFVAL { 1 }
::= { smLaunchEntry 7 }

smLaunchLifeTime OBJECT-TYPE

SYNTAX TimeInterval
UNITS "centi-seconds"
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"The default maximum amount of time a script launched from this entry may run. The value of this object is used to initialize the smRunLifeTime object when a script is launched. Changing the value of an smLaunchLifeTime instance does not affect scripts previously launched from

```

        this entry."
    DEFVAL { 360000 }
    ::= { smLaunchEntry 8 }

```

smLaunchExpireTime OBJECT-TYPE

```

    SYNTAX      TimeInterval
    UNITS        "centi-seconds"
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION

```

"The default maximum amount of time information about a script launched from this entry is kept in the smRunTable after the script has completed execution. The value of this object is used to initialize the smRunExpireTime object when a script is launched. Changing the value of an smLaunchExpireTime instance does not affect scripts previously launched from this entry."

```

    DEFVAL { 360000 }
    ::= { smLaunchEntry 9 }

```

smLaunchStart OBJECT-TYPE

```

    SYNTAX      Integer32 (0..2147483647)
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION

```

"This object is used to start the execution of scripts. When retrieved, the value will be the value of smRunIndex for the last script that started execution by manipulating this object. The value will be zero if no script started execution yet.

A script is started by setting this object to an unused smRunIndex value. A new row in the smRunTable will be created which is indexed by the value supplied by the set-request in addition to the value of smLaunchOwner and smLaunchName. An unused value can be obtained by reading the smLaunchRunIndexNext object.

Setting this object to the special value 0 will start the script with a self-generated smRunIndex value. The consequence is that the script invoker has no reliable way to determine the smRunIndex value for this script invocation and that the invoker has therefore no way to obtain the results from this script invocation. The special value 0 is however useful for scheduled script invocations.

If this object is set, the following checks must be

performed:

- 1) The value of the smLaunchOperStatus object in this entry of the smLaunchTable must be 'enabled'.
- 2) The values of smLaunchScriptOwner and smLaunchScriptName of this row must identify an existing entry in the smScriptTable.
- 3) The value of smScriptOperStatus of this entry must be 'enabled'.
- 4) The principal performing the set operation must have read access to the script. This must be checked by calling the isAccessAllowed abstract service interface defined in RFC 2271 on the row in the smScriptTable identified by smLaunchScriptOwner and smLaunchScriptName. The isAccessAllowed abstract service interface must be called on all columnar objects in the smScriptTable with a MAX-ACCESS value different than 'not-accessible'. The test fails as soon as a call indicates that access is not allowed.
- 5) If the value provided by the set operation is not 0, a check must be made that the value is currently not in use. Otherwise, if the value provided by the set operation is 0, a suitable unused value must be generated.
- 6) The number of currently executing scripts invoked from this smLaunchTable entry must be less than smLaunchMaxRunning.

Attempts to start a script will fail with an inconsistentValue error if one of the checks described above fails.

Otherwise, if all checks have been passed, a new entry in the smRunTable will be created indexed by smLaunchOwner, smLaunchName and the new value for smRunIndex. The value of smLaunchArgument will be copied into smRunArgument, the value of smLaunchLifeTime will be copied to smRunLifeTime, and the value of smLaunchExpireTime will be copied to smRunExpireTime.

The smRunStartTime will be set to the current time and the smRunState will be set to 'initializing' before the script execution is initiated in the appropriate runtime system.

Note that the data type and the range of this object must be consistent with the smRunIndex object. Since this object might be written from the scheduling MIB, the

data type Integer32 rather than Unsigned32 is used."
 DEFVAL { 0 }
 ::= { smLaunchEntry 10 }

smLaunchControl OBJECT-TYPE

SYNTAX INTEGER {
 abort(1),
 suspend(2),
 resume(3),
 nop(4)
 }

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object is used to request a state change for all running scripts in the smRunTable that were started from this row in the smLaunchTable.

Setting this object to abort(1), suspend(2) or resume(3) will set the smRunControl object of all applicable rows in the smRunTable to abort(1), suspend(2) or resume(3) respectively. The phrase 'applicable rows' means the set of rows which were created from this entry in the smLaunchTable and whose value of smRunState allows the corresponding state change as described in the definition of the smRunControl object. Setting this object to nop(4) has no effect.

Attempts to set this object lead to an inconsistentValue error only if all implicated sets on all the applicable rows lead to inconsistentValue errors. It is not allowed to return an inconsistentValue error if at least one state change on one of the applicable rows was successful."

DEFVAL { nop }
 ::= { smLaunchEntry 11 }

smLaunchAdminStatus OBJECT-TYPE

SYNTAX INTEGER {
 enabled(1),
 disabled(2),
 autostart(3)
 }

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of this object indicates the desired status of this launch table entry. The values enabled(1) and autostart(3) both indicate that the launch table entry

should transition into the operational enabled(1) state as soon as the associated script table entry is enabled(1).

The value autostart(3) further indicates that the script is started automatically by conceptually writing the value 0 into the associated smLaunchStart object during the transition from the 'disabled' into the 'enabled' operational state. This is useful for scripts that are to be launched on system start-up."

```
DEFVAL { disabled }
::= { smLaunchEntry 12 }
```

smLaunchOperStatus OBJECT-TYPE

```
SYNTAX      INTEGER {
                enabled(1),
                disabled(2),
                expired(3)
            }
```

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

```
STATUS      current
```

DESCRIPTION

"The value of this object indicates the actual status of this launch table entry. The smLaunchOperStatus object may have the following values:

- 'enabled' indicates that the launch table entry is available and can be used to start scripts.
- 'disabled' indicates that the launch table entry can not be used to start scripts.
- 'expired' indicates that the launch table entry can not be used to start scripts and will disappear as soon as all smRunTable entries associated with this launch table entry have disappeared.

The value 'enabled' requires that the smLaunchRowStatus object is active. The value 'disabled' requires that there are no entries in the smRunTable associated with this smLaunchTable entry."

```
DEFVAL { disabled }
::= { smLaunchEntry 13 }
```

smLaunchRunIndexNext OBJECT-TYPE

```
SYNTAX      Integer32 (1..2147483647)
```

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

```
STATUS      current
```

DESCRIPTION

"This variable is used for creating rows in the smRunTable. The value of this variable is a currently unused value for smRunIndex, which can be written into the smLaunchStart object associated with this row to launch a script.

The value returned when reading this variable must be unique for the smLaunchOwner and smLaunchName associated with this row. Subsequent attempts to read this variable must return different values.

This variable will return the special value 0 if no new rows can be created.

Note that the data type and the range of this object must be consistent with the definition of smRunIndex."

::= { smLaunchEntry 14 }

smLaunchStorageType OBJECT-TYPE

SYNTAX StorageType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object defines if this row is kept in volatile storage and lost upon reboot or if this row is backed up by stable storage.

The value of smLaunchStorageType is only meaningful if the value of the corresponding RowStatus object is active.

If smLaunchStorageType has the value permanent(4), then all objects whose MAX-ACCESS value is read-create must be writable, with the exception of the smLaunchStorageType and smLaunchRowStatus objects, which shall be read-only."

DEFVAL { volatile }

::= { smLaunchEntry 15 }

smLaunchRowStatus OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"A control that allows entries to be added and removed from this table.

Attempts to 'destroy' a row or to set a row 'notInService' while the smLaunchOperStatus is 'enabled' will result in an inconsistentValue error.

Attempts to 'destroy' a row or to set a row 'notInService' where the value of the smLaunchStorageType object is 'permanent' or 'readOnly' will result in an inconsistentValue error.

The value of this object has no effect on whether other objects in this conceptual row can be modified."

::= { smLaunchEntry 16 }

smLaunchError OBJECT-TYPE

SYNTAX SnmpAdminString

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object contains a descriptive error message if an attempt to launch a script fails. Implementations must reset the error message to a zero-length string when a new attempt to launch a script is started."

DEFVAL { ''H }

::= { smLaunchEntry 17 }

smLaunchLastChange OBJECT-TYPE

SYNTAX DateAndTime

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The date and time when this launch table entry was last modified. The value '0000000000000000'H is returned if the launch table entry has not yet been modified.

Note that a change of smLaunchStart, smLaunchControl, smLaunchRunIndexNext, smLaunchRowExpireTime, or the resetting of smLaunchError is not considered a change of this launch table entry."

DEFVAL { '0000000000000000'H }

::= { smLaunchEntry 18 }

smLaunchRowExpireTime OBJECT-TYPE

SYNTAX TimeInterval

UNITS "centi-seconds"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of this object specifies how long this row remains in the 'enabled' or 'disabled' operational state. The value reported by this object ticks backwards. When the value reaches 0, it stops ticking backward and the row is deleted if there are no smRunTable entries associated with

this smLaunchTable entry. Otherwise, the smLaunchOperStatus changes to 'expired' and the row deletion is deferred until there are no smRunTable entries associated with this smLaunchTable entry.

The smLaunchRowExpireTime will not tick backwards if it is set to its maximum value (2147483647). In other words, setting this object to its maximum value turns the timer off.

The value of this object may be set in order to increase or reduce the remaining time that the launch table entry may be used. Setting the value to 0 will cause an immediate row deletion or transition into the 'expired' operational state.

It is not possible to set this object while the operational status is 'expired'. Attempts to modify this object while the operational status is 'expired' leads to an inconsistentValue error.

Note that the timer ticks backwards independent of the operational state of the launch table entry."

```
DEFVAL { 2147483647 }
::= { smLaunchEntry 19 }
```

smRunTable OBJECT-TYPE

SYNTAX SEQUENCE OF SmRunEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table lists and describes scripts that are currently running or have been running in the past."

```
::= { smRunObjects 2 }
```

smRunEntry OBJECT-TYPE

SYNTAX SmRunEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry describing a particular running or finished script."

INDEX { smLaunchOwner, smLaunchName, smRunIndex }

```
::= { smRunTable 1 }
```

```
SmRunEntry ::= SEQUENCE {
    smRunIndex      Integer32,
```

```

smRunArgument      OCTET STRING,
smRunStartTime     DateAndTime,
smRunEndTime       DateAndTime,
smRunLifeTime      TimeInterval,
smRunExpireTime    TimeInterval,
smRunExitCode      INTEGER,
smRunResult        OCTET STRING,
smRunControl       INTEGER,
smRunState         INTEGER,
smRunError         SnmpAdminString,
smRunResultTime    DateAndTime,
smRunErrorTime     DateAndTime
}

```

smRunIndex OBJECT-TYPE

```

SYNTAX      Integer32 (1..2147483647)
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION

```

"The locally arbitrary, but unique identifier associated with this running or finished script. This value must be unique for all rows in the smRunTable with the same smLaunchOwner and smLaunchName.

Note that the data type and the range of this object must be consistent with the definition of smLaunchRunIndexNext and smLaunchStart."

```
 ::= { smRunEntry 1 }
```

smRunArgument OBJECT-TYPE

```

SYNTAX      OCTET STRING
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION

```

"The argument supplied to the script when it started."

```
DEFVAL { ''H }
```

```
 ::= { smRunEntry 2 }
```

smRunStartTime OBJECT-TYPE

```

SYNTAX      DateAndTime
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION

```

"The date and time when the execution started. The value '0000000000000000'H is returned if the script has not started yet."

```
DEFVAL { '0000000000000000'H }
```

```
 ::= { smRunEntry 3 }
```

smRunEndTime OBJECT-TYPE

SYNTAX DateAndTime

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The date and time when the execution terminated. The value '0000000000000000'H is returned if the script has not terminated yet."

DEFVAL { '0000000000000000'H }

::= { smRunEntry 4 }

smRunLifeTime OBJECT-TYPE

SYNTAX TimeInterval

UNITS "centi-seconds"

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This object specifies how long the script can execute. This object returns the remaining time that the script may run. The object is initialized with the value of the associated smLaunchLifeTime object and ticks backwards. The script is aborted immediately when the value reaches 0.

The value of this object may be set in order to increase or reduce the remaining time that the script may run. Setting this value to 0 will abort script execution immediately, and, if the value of smRunExpireTime is also 0, will remove this entry from the smRunTable once it has terminated.

If smRunLifeTime is set to its maximum value (2147483647), either by a set operation or by its initialization from the smLaunchLifeTime object, then it will not tick backwards. A running script with a maximum smRunLifeTime value will thus never be terminated with a 'lifeTimeExceeded' exit code.

The value of smRunLifeTime reflects the real-time execution time as seen by the outside world. The value of this object will always be 0 for a script that finished execution, that is smRunState has the value 'terminated'.

The value of smRunLifeTime does not change while a script is suspended, that is smRunState has the value 'suspended'. Note that this does not affect set operations. It is legal to modify smRunLifeTime via set operations while a script is suspended."

::= { smRunEntry 5 }

smRunExpireTime OBJECT-TYPE

SYNTAX TimeInterval

UNITS "centi-seconds"

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"The value of this object specifies how long this row can exist in the smRunTable after the script has terminated. This object returns the remaining time that the row may exist before it is aged out. The object is initialized with the value of the associated smLaunchExpireTime object and ticks backwards. The entry in the smRunTable is destroyed when the value reaches 0 and the smRunState has the value 'terminated'.

The value of this object may be set in order to increase or reduce the remaining time that the row may exist. Setting the value to 0 will destroy this entry as soon as the smRunState has the value 'terminated'."

```
::= { smRunEntry 6 }
```

smRunExitCode OBJECT-TYPE

```
SYNTAX      INTEGER {
                noError(1),
                halted(2),
                lifeTimeExceeded(3),
                noResourcesLeft(4),
                languageError(5),
                runtimeError(6),
                invalidArgument(7),
                securityViolation(8),
                genericError(9)
            }
```

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object indicates the reason why a script finished execution. The smRunExitCode code may have one of the following values:

- 'noError', which indicates that the script completed successfully without errors;
- 'halted', which indicates that the script was halted by a request from an authorized manager;
- 'lifeTimeExceeded', which indicates that the script exited because a time limit was exceeded;

- 'noResourcesLeft', which indicates that the script exited because it ran out of resources (e.g. memory);
- 'languageError', which indicates that the script exited because of a language error (e.g. a syntax error in an interpreted language);
- 'runtimeError', which indicates that the script exited due to a runtime error (e.g. a division by zero);
- 'invalidArgument', which indicates that the script could not be run because of invalid script arguments;
- 'securityViolation', which indicates that the script exited due to a security violation;
- 'genericError', which indicates that the script exited for an unspecified reason.

If the script has not yet begun running, or is currently running, the value will be 'noError'."

DEFVAL { noError }
 ::= { smRunEntry 7 }

smRunResult OBJECT-TYPE

SYNTAX OCTET STRING

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The result value produced by the running script. Note that the result may change while the script is executing."

DEFVAL { ''H }
 ::= { smRunEntry 8 }

smRunControl OBJECT-TYPE

SYNTAX INTEGER {
 abort(1),
 suspend(2),
 resume(3),
 nop(4)
 }

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"The value of this object indicates the desired status of the script execution defined by this row.

Setting this object to 'abort' will abort execution if the

value of smRunState is 'initializing', 'executing', 'suspending', 'suspended' or 'resuming'. Setting this object to 'abort' when the value of smRunState is 'aborting' or 'terminated', or if the implementation can determine that the attempt to abort the execution would fail, will result in an inconsistentValue error.

Setting this object to 'suspend' will suspend execution if the value of smRunState is 'executing'. Setting this object to 'suspend' will cause an inconsistentValue error if the value of smRunState is not 'executing' or if the implementation can determine that the attempt to suspend the execution would fail.

Setting this object to 'resume' will resume execution if the value of smRunState is 'suspending' or 'suspended'. Setting this object to 'resume' will cause an inconsistentValue error if the value of smRunState is not 'suspended' or if the implementation can determine that the attempt to resume the execution would fail.

Setting this object to nop(4) has no effect."

DEFVAL { nop }

::= { smRunEntry 9 }

smRunState OBJECT-TYPE

SYNTAX INTEGER {
 initializing(1),
 executing(2),
 suspending(3),
 suspended(4),
 resuming(5),
 aborting(6),
 terminated(7)
 }

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object indicates the script's execution state. If the script has been invoked but has not yet begun execution, the value will be 'initializing'. If the script is running, the value will be 'executing'.

A running script which received a request to suspend execution first transitions into a temporary 'suspending' state. The temporary 'suspending' state changes to 'suspended' when the script has actually been suspended. The temporary 'suspending' state changes back to 'executing' if

the attempt to suspend the running script fails.

A suspended script which received a request to resume execution first transitions into a temporary 'resuming' state. The temporary 'resuming' state changes to 'running' when the script has actually been resumed. The temporary 'resuming' state changes back to 'suspended' if the attempt to resume the suspended script fails.

A script which received a request to abort execution but which is still running first transitions into a temporary 'aborting' state.

A script which has finished its execution is 'terminated'."
::= { smRunEntry 10 }

smRunError OBJECT-TYPE

SYNTAX SnmpAdminString

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object contains a descriptive error message if the script startup or execution raised an abnormal condition. An implementation must store a descriptive error message in this object if the script exits with the smRunExitCode 'genericError'."

DEFVAL { ''H }

::= { smRunEntry 11 }

smRunResultTime OBJECT-TYPE

SYNTAX DateAndTime

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The date and time when the smRunResult was last updated. The value '0000000000000000'H is returned if smRunResult has not yet been updated after the creation of this smRunTable entry."

DEFVAL { '0000000000000000'H }

::= { smRunEntry 12 }

smRunErrorTime OBJECT-TYPE

SYNTAX DateAndTime

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The date and time when the smRunError was last updated. The value '0000000000000000'H is returned if smRunError

```

        has not yet been updated after the creation of this
        smRunTable entry."
DEFVAL { '0000000000000000'H }
::= { smRunEntry 13 }

--
-- Notifications. The definition of smTraps makes notification
-- registrations reversible (see STD 58, RFC 2578).
--

smTraps OBJECT IDENTIFIER ::= { smNotifications 0 }

smScriptAbort NOTIFICATION-TYPE
    OBJECTS      { smRunExitCode, smRunEndTime, smRunError }
    STATUS       current
    DESCRIPTION
        "This notification is generated whenever a running script
        terminates with an smRunExitCode unequal to 'noError'."
    ::= { smTraps 1 }

smScriptResult NOTIFICATION-TYPE
    OBJECTS      { smRunResult }
    STATUS       current
    DESCRIPTION
        "This notification can be used by scripts to notify other
        management applications about results produced by the
        script.

        This notification is not automatically generated by the
        Script MIB implementation. It is the responsibility of
        the executing script to emit this notification where it
        is appropriate to do so."
    ::= { smTraps 2 }

smScriptException NOTIFICATION-TYPE
    OBJECTS      { smRunError }
    STATUS       current
    DESCRIPTION
        "This notification can be used by scripts to notify other
        management applications about script errors.

        This notification is not automatically generated by the
        Script MIB implementation. It is the responsibility of
        the executing script or the runtime system to emit this
        notification where it is appropriate to do so."
    ::= { smTraps 3 }

-- conformance information

```

```
smCompliances OBJECT IDENTIFIER ::= { smConformance 1 }
smGroups       OBJECT IDENTIFIER ::= { smConformance 2 }

-- compliance statements

smCompliance2 MODULE-COMPLIANCE
    STATUS          current
    DESCRIPTION
        "The compliance statement for SNMP entities which implement
        the Script MIB."
    MODULE          -- this module
    MANDATORY-GROUPS {
        smLanguageGroup, smScriptGroup2, smLaunchGroup2,
        smRunGroup2, smNotificationsGroup2
    }
    GROUP           smCodeGroup
    DESCRIPTION
        "The smCodeGroup is mandatory only for those implementations
        that support the downloading of scripts via SNMP."
    OBJECT smScriptSource
    MIN-ACCESS      read-only
    DESCRIPTION
        "The smScriptSource object is read-only for implementations
        that are not able to download script code from a URL."
    OBJECT smCodeText
    DESCRIPTION
        "A compliant implementation need only support write access to
        the smCodeText object only during row creation."
    OBJECT smLaunchArgument
    DESCRIPTION
        "A compliant implementation has to support a minimum size
        for smLaunchArgument of 255 octets."
    OBJECT smRunArgument
    DESCRIPTION
        "A compliant implementation has to support a minimum size
        for smRunArgument of 255 octets."
    OBJECT smRunResult
    DESCRIPTION
        "A compliant implementation has to support a minimum size
        for smRunResult of 255 octets."
    OBJECT smRunState
    DESCRIPTION
        "A compliant implementation does not have to support script
        suspension and the smRunState 'suspended'. Such an
        implementation will change into the 'suspending' state
        when the smRunControl is set to 'suspend' and remain in this
        state until smRunControl is set to 'resume' or the script
        terminates."
```

```
 ::= { smCompliances 2 }

smLanguageGroup OBJECT-GROUP
  OBJECTS {
    smLangLanguage, smLangVersion,
    smLangVendor, smLangRevision,
    smLangDescr, smExtsnExtension,
    smExtsnVersion, smExtsnVendor,
    smExtsnRevision, smExtsnDescr
  }
  STATUS      current
  DESCRIPTION
    "A collection of objects providing information about the
     capabilities of the scripting engine."
  ::= { smGroups 1 }

smScriptGroup2 OBJECT-GROUP
  OBJECTS {
    smScriptDescr, smScriptLanguage,
    smScriptSource, smScriptAdminStatus,
    smScriptOperStatus, smScriptStorageType,
    smScriptRowStatus, smScriptError,
    smScriptLastChange
  }
  STATUS      current
  DESCRIPTION
    "A collection of objects providing information about
     installed scripts."
  ::= { smGroups 7 }

smCodeGroup OBJECT-GROUP
  OBJECTS {
    smCodeText, smCodeRowStatus
  }
  STATUS      current
  DESCRIPTION
    "A collection of objects used to download or modify scripts
     by using SNMP set requests."
  ::= { smGroups 3 }

smLaunchGroup2 OBJECT-GROUP
  OBJECTS {
    smLaunchScriptOwner, smLaunchScriptName,
    smLaunchArgument, smLaunchMaxRunning,
    smLaunchMaxCompleted, smLaunchLifeTime,
    smLaunchExpireTime, smLaunchStart,
    smLaunchControl, smLaunchAdminStatus,
    smLaunchOperStatus, smLaunchRunIndexNext,
```

```

        smLaunchStorageType, smLaunchRowStatus,
        smLaunchError, smLaunchLastChange,
        smLaunchRowExpireTime
    }
    STATUS          current
    DESCRIPTION
        "A collection of objects providing information about scripts
        that can be launched."
    ::= { smGroups 8 }

smRunGroup2 OBJECT-GROUP
    OBJECTS {
        smRunArgument, smRunStartTime,
        smRunEndTime, smRunLifeTime,
        smRunExpireTime, smRunExitCode,
        smRunResult, smRunState,
        smRunControl, smRunError,
        smRunResultTime, smRunErrorTime
    }
    STATUS          current
    DESCRIPTION
        "A collection of objects providing information about running
        scripts."
    ::= { smGroups 9 }

smNotificationsGroup2 NOTIFICATION-GROUP
    NOTIFICATIONS {
        smScriptAbort,
        smScriptResult,
        smScriptException
    }
    STATUS          current
    DESCRIPTION
        "The notifications emitted by the Script MIB."
    ::= { smGroups 10 }

--
-- Deprecated compliance and conformance group definitions
-- from RFC 2592.
--

smCompliance MODULE-COMPLIANCE
    STATUS          deprecated
    DESCRIPTION
        "The compliance statement for SNMP entities which implement
        the Script MIB."
    MODULE          -- this module
    MANDATORY-GROUPS {

```

```

        smLanguageGroup, smScriptGroup, smLaunchGroup, smRunGroup
    }
GROUP      smCodeGroup
DESCRIPTION
    "The smCodeGroup is mandatory only for those implementations
    that support the downloading of scripts via SNMP."
OBJECT     smScriptSource
MIN-ACCESS read-only
DESCRIPTION
    "The smScriptSource object is read-only for implementations
    that are not able to download script code from a URL."
OBJECT     smCodeText
DESCRIPTION
    "A compliant implementation need only support write access
    to the smCodeText object during row creation."
OBJECT     smLaunchArgument
DESCRIPTION
    "A compliant implementation has to support a minimum size
    for smLaunchArgument of 255 octets."
OBJECT     smRunArgument
DESCRIPTION
    "A compliant implementation has to support a minimum size
    for smRunArgument of 255 octets."
OBJECT     smRunResult
DESCRIPTION
    "A compliant implementation has to support a minimum size
    for smRunResult of 255 octets."
OBJECT     smRunState
DESCRIPTION
    "A compliant implementation does not have to support script
    suspension and the smRunState 'suspended'. Such an
    implementation will change into the 'suspending' state
    when the smRunControl is set to 'suspend' and remain in this
    state until smRunControl is set to 'resume' or the script
    terminates."
::= { smCompliances 1 }

smScriptGroup OBJECT-GROUP
OBJECTS {
    smScriptDescr, smScriptLanguage,
    smScriptSource, smScriptAdminStatus,
    smScriptOperStatus, smScriptStorageType,
    smScriptRowStatus
}
STATUS      deprecated
DESCRIPTION
    "A collection of objects providing information about
    installed scripts."

```

```
 ::= { smGroups 2 }

smLaunchGroup OBJECT-GROUP
  OBJECTS {
    smLaunchScriptOwner, smLaunchScriptName,
    smLaunchArgument, smLaunchMaxRunning,
    smLaunchMaxCompleted, smLaunchLifeTime,
    smLaunchExpireTime, smLaunchStart,
    smLaunchControl, smLaunchAdminStatus,
    smLaunchOperStatus, smLaunchRunIndexNext,
    smLaunchStorageType, smLaunchRowStatus
  }
  STATUS      deprecated
  DESCRIPTION
    "A collection of objects providing information about scripts
     that can be launched."
  ::= { smGroups 4 }

smRunGroup OBJECT-GROUP
  OBJECTS {
    smRunArgument, smRunStartTime,
    smRunEndTime, smRunLifeTime,
    smRunExpireTime, smRunExitCode,
    smRunResult, smRunState,
    smRunControl, smRunError
  }
  STATUS      deprecated
  DESCRIPTION
    "A collection of objects providing information about running
     scripts."
  ::= { smGroups 5 }

smNotificationsGroup NOTIFICATION-GROUP
  NOTIFICATIONS {
    smScriptAbort,
    smScriptResult
  }
  STATUS      deprecated
  DESCRIPTION
    "The notifications emitted by the Script MIB."
  ::= { smGroups 6 }

END
```

7. Usage Examples

This section presents some examples that explain how a manager can use the Script MIB defined in this memo. The purpose of these examples is to explain the steps that are normally used to delegate management scripts.

7.1. Pushing a Script via SNMP

This example explains the steps performed by a manager to push a script into a distributed manager.

1. The manager first checks the smLangTable and the smExtnTable in order to select the appropriate script or language.
2. The manager creates a row in the smScriptTable by issuing an SNMP set-request. The smScriptRowStatus object is set to 'createAndWait' and the smScriptSource object is set to an empty string. The smScriptLanguage object is set to the language in which the script was written. The smScriptStorageType object is set to 'volatile' to indicate that the script will be loaded via the smCodeTable. The smScriptOwner is set to a string which identifies the principal who owns the new row. The smScriptName defines the administratively assigned unique name for the script.
3. The manager sets the smScriptRowStatus object to 'active' and the smScriptAdminStatus object to 'editing'.
4. The manager pushes the script to the distributed manager by issuing a couple of SNMP set-requests to fill the smCodeTable.
5. Once the whole script has been transferred, the manager sends a set-request to set the smScriptAdminStatus object to 'enabled'. The Script MIB implementation now makes the script accessible to the runtime system. This might include the compilation of the script if the language requires a compilation step.
6. The manager polls the smScriptOperStatus object until the value is either 'enabled' or one of the error status codes. The script can only be used if the value of smScriptOperStatus is 'enabled'.
7. If the manager wants to store the script in local non-volatile storage, it should send a set-request which changes the smScriptStorageType object to 'nonVolatile'.

7.2. Pulling a Script from a URL

This example explains the steps performed by a manager to cause a distributed manager to pull a script from a URL.

1. The manager first checks the smLangTable and the smExtsnTable in order to select the appropriate script or language.
2. The manager creates a row in the smScriptTable by issuing an SNMP set-request. The smScriptRowStatus object is set to 'createAndWait' and the smScriptSource object is set to the URL which points to the script source. The smScriptLanguage object is set to the language in which the script was written. The smScriptOwner is set to a string which identifies the principal who owns the new row. The smScriptName defines the administratively assigned unique name for the script.
3. The manager sets the smScriptRowStatus object to 'active'.
4. The manager sends a set-request to set the smScriptAdminStatus object to 'enabled'. The Script MIB implementation now makes the script accessible to the runtime system. This causes a retrieval operation to pull the script from the URL stored in smScriptSource. This retrieval operation might be followed by a compile operation if the language requires a compilation step.
5. The manager polls the smScriptOperStatus object until the value is either 'enabled' or one of the error status codes. The script can only be used if the value of smScriptOperStatus is 'enabled'.
6. If the manager wants to store the script in local non-volatile storage, it should send a set-request which changes the smScriptStorageType object to 'nonVolatile'.

7.3. Modifying an Existing Script

This section explains how a manager can modify a script by sending SNMP set-requests.

1. First, the script is de-activated by setting the smScriptAdminStatus to 'disabled'.
2. The manager polls the smScriptOperStatus object until the value is 'disabled'.
3. The manager sets smScriptSource to an empty string and smScriptAdminStatus to 'editing'. This makes the script source available in the smCodeTable.

4. The manager polls the smScriptOperStatus object until the value is 'editing'.
5. The manager sends SNMP set-requests to modify the script in the smCodeTable.
6. The manager sends a set-request to set the smScriptAdminStatus object to 'enabled'. The Script MIB implementation now makes the script accessible to the runtime system. This might include the compilation of the script if the language requires a compilation step.
7. The manager polls the smScriptOperStatus object until the value is either 'enabled' or one of the error status codes. The script can only be used if the value of smScriptOperStatus is 'enabled'.

7.4. Removing an Existing Script

This section explains how a manager can remove a script from a distributed manager.

1. First, the manager sets the smScriptAdminStatus to 'disabled'. This will ensure that no new scripts can be started while running scripts finish their execution.
2. The manager polls the smScriptOperStatus object until the value is 'disabled'.
3. The manager sends an SNMP set-request to change the smScriptRowStatus object to 'destroy'. This will remove the row and all associated resources from the Script MIB implementation.

7.5. Creating a Launch Button

This section explains how a manager can create a launch button for starting a script.

1. The manager, who is identified by an smLaunchOwner value, first chooses a name for the new row in the smLaunchTable. The manager sends an SNMP set-request to set the smLaunchRowStatus object for this smLaunchOwner and smLaunchName to 'createAndWait'.
2. The manager fills the new smLaunchTable row with all required parameters. The smLaunchScriptOwner and smLaunchScriptName values point to the script that should be started from this launch button.
3. The manager sets the smLaunchRowStatus object to 'active'.

4. The manager sends a set-request to change smLaunchAdminStatus to 'enabled' once the new smLaunchTable row is complete.
5. The manager polls the smLaunchOperStatus object until the value is 'enabled'.

7.6. Launching a Script

This section explains the suggested way to launch a script from a given launch button.

1. The manager first retrieves the value of smLaunchRunIndexNext from the launch button selected to start the script.
2. The manager sends an SNMP set-request to set the smLaunchStart object to the value obtained in step 1. This will launch the script if all necessary pre-conditions are satisfied (see the definition of smLaunchStart for more details). The manager can also provide the smLaunchArgument in the same set-request that is used to start the script. Upon successful start, a new row will be created in the smRunTable indexed by smLaunchOwner, smLaunchName and the value written to smLaunchStart.
3. The manager polls the smRunState object until the value is either 'executing' (the default case), 'suspended' or 'terminated'.

The first step is not required. A manager can also try to guess an unused value for smRunIndex if the manager wants to start the script in a single transaction. A manager can also use the special value 0 if it does not care about the smRunIndex.

7.7. Suspending a Running Script

This section explains how a manager can suspend a running script.

1. The manager sets the smRunControl object of the running script or the smLaunchControl object of the launch button used to start the running script to 'suspend'. Setting smLaunchControl will suspend all running scripts started from the launch button while smRunControl will only suspend the running script associated with the smRunControl instance.
2. The manager polls the smRunState object until the value is either 'suspended', 'executing', or 'terminated'. If the value is 'suspended', then the suspend operation was successful. If the value is 'executing', then the attempt to suspend the script

failed. The value 'terminated' can be received in cases where the suspend operation failed and the running script terminated between the polls.

Note that the set operation in the first step can lead to an inconsistentValue error which indicates that the suspend operation failed (e.g., because the runtime system does not support suspend/resume). There is no need to poll smRunState in this case.

7.8. Resuming a Suspended Script

This section explains how a manager can resume a suspended script.

1. The manager sets the smRunControl object of the running script or the smLaunchControl object of the launch button used to start the running script to 'resume'. Setting smLaunchControl will resume all running scripts started from the launch button while smRunControl will only resume the running script associated with the smRunControl instance.
2. The manager polls the smRunState object until the value is either 'suspended', 'executing', or 'terminated'. If the value is 'executing', then the resume operation was successful. If the value is 'suspended', then the attempt to resume the script failed. The value 'terminated' can be received in cases where the resume operation was successful and the running script terminated between the polls.

Note that the set operation in the first step can lead to an inconsistentValue error which indicates that the resume operation failed (e.g., because the runtime system does not support suspend/resume). There is no need to poll smRunState in this case.

7.9. Terminating a Running Script

This section explains two ways to terminate a running script. The first approach is as follows:

1. The manager sets the smRunControl object of the running script or the smLaunchControl object of the launch button used to start the running script to 'abort'. Setting smLaunchControl will abort all running scripts started from the launch button while smRunControl will only abort the running script associated with the smRunControl instance.
2. The manager polls the smRunState object until the value is 'terminated'.

The second way to terminate a script is to set the `smRunLifeTime` to zero which causes the runtime system to terminate the script with a 'lifeTimeExceeded' exit code:

1. The manager changes the value of `smRunLifeTime` to 0. This causes the Script MIB implementation to abort the script because the remaining life time has expired.
2. The manager polls the `smRunState` object until the value is 'terminated'.

Note that changing the `smRunLifeTime` value can also be used to increase the permitted lifetime of a running script. For example, a manager can choose to set `smRunLifeTime` to a small fixed time interval and increase the value periodically. This strategy has the nice effect that scripts terminate automatically if the manager loses contact with the Script MIB engine.

7.10. Removing a Terminated Script

This section explains how a manager can remove a terminated script.

1. The manager changes the `smRunExpireTime` to 0. This causes the Script MIB implementation to destroy the `smRunTable` entry of the terminated script.

7.11. Removing a Launch Button

This section explains how a manager can remove a launch button from a distributed manager.

1. First, the manager sets the `smLaunchAdminStatus` to 'disabled'. This will ensure that no new scripts can be started from this launch button while running scripts finish their execution.
2. The manager polls the `smLaunchOperStatus` object until the value is 'disabled'.
3. The manager sends an SNMP set-request to change the `smLaunchRowStatus` object to 'destroy'. This will remove the row and all associated resources from the Script MIB implementation.

8. VACM Configuration Examples

This section shows how the view-based access control model defined in RFC 2575 [RFC2575] can be configured to control access to the Script MIB.

8.1. Sandbox for Guests

The first example demonstrates how to configure VACM to give the members of the VACM group "guest" limited access to the Script MIB. The MIB views defined below give the members of the "guest" group a sandbox where they can install and start their own scripts, but not access any other scripts maintained by the Script MIB implementation.

```
vacmAccessReadView."guest"."".usm.authNoPriv = "guestReadView"  
vacmAccessWriteView."guest"."".usm.authNoPriv = "guestWriteView"
```

The guestReadView grants read access to the smLangTable, the smExtsnTable and to all the table entries owned by "guest":

```
guestReadView:  
    smLangTable                (included)  
    smExtsnTable               (included)  
    smScriptObjects.*.*.*."guest" (included)  
    smRunObjects.*.*.*."guest"   (included)
```

The guestWriteView grants write access to all the table entries owned by "guest":

```
guestWriteView:  
    smScriptObjects.*.*.*."guest" (included)  
    smRunObjects.*.*.*."guest"   (included)
```

8.2. Sharing Scripts

This example demonstrates how VACM can be used to share a repository of scripts between the members of the "senior" and the members of the "junior" VACM group:

```
vacmAccessReadView."junior"."".usm.authNoPriv = "juniorReadView"  
vacmAccessWriteView."junior"."".usm.authNoPriv = "juniorWriteView"
```

```
juniorReadView:  
    smLangTable                (included)  
    smExtsnTable               (included)  
    smScriptObjects.*.*.*."junior" (included)  
    smRunObjects.*.*.*."junior"   (included)  
    smScriptObjects.*.*.*."utils" (included)
```

```
juniorWriteView:  
    smScriptObjects.*.*.*."junior" (included)  
    smRunObjects.*.*.*."junior"   (included)
```

The definitions above allow the members of the "junior" VACM group to start the scripts owned by "utils" in addition to the script the members of the "junior" VACM group installed themselves. This is accomplished by giving the members of "junior" read access to scripts in "utils". This allows members of "junior" to create entries in the smLaunchTable which refer to scripts in "utils", and to launch those scripts using these entries in the smLaunchTable.

```
vacmAccessReadView."senior"."".usm.authNoPriv = "seniorReadView"
vacmAccessWriteView."senior"."".usm.authNoPriv = "seniorWriteView"
```

```
seniorReadView:
    smLangTable                (included)
    smExtnTable                (included)
    smScriptObjects.*.*.*."senior" (included)
    smRunObjects.*.*.*."senior" (included)
    smScriptObjects.*.*.*."utils" (included)
```

```
seniorWriteView:
    smScriptObjects.*.*.*."senior" (included)
    smRunObjects.*.*.*."senior" (included)
    smScriptObjects.*.*.*."utils" (included)
```

The definitions for the members of the "senior" VACM group allow to start the scripts owned by "utils" in addition to the script the members of the "senior" VACM group installed themselves. The third write access rule in the seniorWriteView also grants the permission to install scripts owned by "utils". The members of the "senior" VACM group therefore have the permissions to install and modify scripts that can be called by the members of the "junior" VACM group.

8.3. Emergency Scripts

This example demonstrates how VACM can be used to allow the members of the "junior" VACM group to launch scripts that are executed with the permissions associated with the "emergency" owner. This works by adding the following rules to the juniorReadView and the juniorWriteView:

```
juniorReadView:
    smScriptObjects.*.*.*."emergency" (included)
    smRunObjects.*.*.*."emergency" (included)

juniorWriteView
    smLaunchStart."emergency" (included)
    smLaunchArgument."emergency" (included)
```

The rules added to the juniorReadView grant read access to the scripts, the launch buttons and the results owned by "emergency". The rules added to the juniorWriteView grant write permissions to the smLaunchStart and smLaunchArgument variables owned by "emergency". Members of the "junior" VACM group can therefore start scripts that will execute under the owner "emergency".

```
seniorReadView:
    smScriptObjects.*.*.*."emergency" (included)
    smRunObjects.*.*.*."emergency"    (included)
```

```
seniorWriteView:
    smScriptObjects.*.*.*."emergency" (included)
    smRunObjects.*.*.*."emergency"    (included)
```

The rules added to the seniorReadView and the seniorWriteView will give the members of the "senior" VACM group the rights to install emergency scripts and to configure appropriate launch buttons.

9. IANA Considerations

The Internet Assigned Numbers Authority (IANA) is responsible for maintaining a MIB module (IANA-LANGUAGE-MIB) which provides OID registrations for well-known languages. The IANA language registry is intended to reduce interoperability problems by providing a single list of well-known languages. However, it is of course still possible to register languages in private OID spaces. Registering languages in private OID spaces is especially attractive if a language is used for experimentation or if a language is only used in environments where the distribution of MIB modules with the language registration does not cause any maintenance problems.

Any additions or changes to the list of languages registered via IANA require Designated Expert Review as defined in the IANA guidelines [RFC2434]. The Designated Expert will be selected by the IESG Area Director for the IETF Operations and Management Area.

10. Security Considerations

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

SNMPv1 by itself is not a secure environment. Even if the network itself is secure (for example by using IPSec), even then, there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB.

It is recommended that the implementers consider the security features as provided by the SNMPv3 framework. Specifically, the use of the User-based Security Model RFC 2574 [RFC2574] and the View-based Access Control Model RFC 2575 [RFC2575] is recommended.

It is then a customer/user responsibility to ensure that the SNMP entity giving access to an instance of this MIB, is properly configured to give access to the objects only to those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

This MIB provides the ability to distribute applications written in an arbitrary language to remote systems in a network. The security features of the languages available in a particular implementation should be taken into consideration when deploying an implementation of this MIB.

To facilitate the provisioning of access control by a security administrator using the View-Based Access Control Model (VACM) defined in RFC 2575 [RFC2575] for tables in which multiple users may need to independently create or modify entries, the initial index is used as an "owner index". Such an initial index has a syntax of SnmpAdminString, and can thus be trivially mapped to a securityName or groupName as defined in VACM, in accordance with a security policy.

All entries in related tables belonging to a particular user will have the same value for this initial index. For a given user's entries in a particular table, the object identifiers for the information in these entries will have the same subidentifiers (except for the "column" subidentifier) up to the end of the encoded owner index. To configure VACM to permit access to this portion of the table, one would create vacmViewTreeFamilyTable entries with the value of vacmViewTreeFamilySubtree including the owner index portion, and vacmViewTreeFamilyMask "wildcarding" the column subidentifier. More elaborate configurations are possible.

The VACM access control mechanism described above provides control over SNMP access to Script MIB objects. There are a number of other access control issues that are outside of the scope of this MIB. For example, access control on URLs, especially those that use the file scheme, must be realized by the underlying operating system. A mapping of the owner index value to a local operating system security

user identity should be used by an implementation of this MIB to control access to operating system resources when resolving URLs or executing scripts.

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12. Changes from RFC 2592

The following list documents major changes from the previous version of this document, published as RFC 2592:

- Updated the boilerplate and the references.
- Added revision clauses to the module identity macro.
- Various typos have been fixed.
- Added SIZE restriction to smScriptName which is consistent with smLaunchScriptName. Added DEFVAL and some clarifying text on the usage of a zero-length string to smLaunchScriptName.
- Clarified under which conditions changes to smScriptLanguage are invalid.
- Added new smScriptError and smLaunchError objects.
- Setting smRunLifeTime to its maximum value now disables the timer so that scripts can run forever.

- Added the 'autostart' value to the smLaunchAdminStatus object which allows to launch scripts during the disable->enabled transition of smLaunchOperStatus.
- Added an additional step to the "creating a launch button" procedure which sets the smLaunchRowStatus to active.
- Added a final polling step in the procedure to launch a script.
- Added a final polling step in the procedure to terminate a running script.
- Removed the requirement that smRunError is a zero-length string while the smRunExitCode has the value 'noError'.
- Added new smScriptLastChange, smLaunchLastChange, smRunResultTime, and smRunErrorTime objects.
- Added some additional boilerplate text to the security considerations section.
- Added a new smLaunchRowExpireTime object and a new 'expired' state to the smLaunchOperStatus object.
- Clarified that the smRunState object reports the actual state if attempts to suspend or resume scripts fail.
- Clarified the conditions under which set operations to smLaunchControl and smRunControl can lead to inconsistentValue errors.
- Added procedures for suspending/resuming/removing running scripts to section 7.
- Added text to the smScriptStorageType description to better highlight the difference between the storage type of the script row entry and the script itself.
- Updated the smCompliances statement to not require write access to the smCodeText object after row creation.
- Deprecated smCompliance, smScriptGroup, smLaunchGroup, smRunGroup, smNotificationsGroup and created smCompliance2, smScriptGroup2, smLaunchGroup2, smRunGroup2 and smNotificationsGroup2 that take care of the new objects and notifications.

13. Acknowledgments

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