Definitions of Managed Objects for Applications

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Cheryl Krupczak
Empire Technologies, Inc.
cheryl@empiretech.com

Jonathan Saperia
BGS Systems Inc.
saperia@bgs.com

Rick Sturm
Enterprise Management Professional Services, Inc.
sturm@emi-summit.com

Jonathan Weinstock
General Instrument Corporation
jweinstock@gic.gi.com

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1. Abstract

This memo defines an experimental portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes a basic set of managed objects for fault, configuration and performance management of applications from a systems perspective. More specifically, the managed objects are restricted to information that can be determined from the system itself and which does not require special instrumentation within the applications to make the information available.

This memo does not specify a standard for the Internet community.

2. The SNMPv2 Network Management Framework

The SNMPv2 Network Management Framework consists of the following major components:

- **RFC 1902** Structure of Management Information for Version 2 of the Simple Network Management Protocol (SNMPv2)
- **RFC 1903** Textual Conventions for Version 2 of the Simple Network Management Protocol (SNMPv2)
- **RFC 1904** Conformance Statements for Version 2 of the Simple Network Management Protocol (SNMPv2)
- **RFC 1906** Transport Mappings for Version 2 of the Simple Network Management Protocol (SNMPv2)
- **RFC 1907** Management Information Base for Version 2 of the Simple Network Management Protocol (SNMPv2)
- **RFC 1908** Coexistence between Version 1 and Version 2 of the Internet-standard Network Management Framework
The Framework permits new objects to be defined for the purpose of experimentation and evaluation.

2.1. Object Definitions

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the subset of Abstract Syntax Notation One (ASN.1) [1], defined in the Structure of Management Information (SMI) (See RFC 1902 [2]). In particular, each object type is named by an OBJECT IDENTIFIER, an administratively assigned name. The object type together with an object instance serves to uniquely identify a specific instantiation of the object. For human convenience, we often use a textual string, termed the object descriptor, to refer to the object type.
3. Overview

The primary purpose of computing technologies is the execution of application software. These applications, typically specialized collections of executables, files, and interprocess communications, exist to solve business, scientific or other "problems". The configuration, fault detection, performance monitoring and control of application software across its life on a host computer is of great economic importance. For the purposes of our work, we define applications as one or more units of executable code and other resources, installed on a single host system that a manager may think of as a single object for management purposes.

The information described by the objects in the System Application MIB support configuration, fault, and performance management; they represent some of the basic attributes of application software from a systems (non-application specific) perspective. The information allows for the description of applications as collections of executables and files installed and executing on a host computer.

This draft is concerned primarily with, and defines a model for, application information resident on a host computer which can be determined from the system itself, and not from the individual applications. This system-level view of applications is designed to provide information about software applications installed and running on the host system without requiring modifications and code additions to the applications themselves. This approach was taken to insure ease and speed of implementation, while allowing room for future growth.
4. Architecture for Application Management

In the area of application management it is fully acknowledged and even expected that additional MIB modules will be defined over time to provide an even greater level of detail regarding applications. This MIB module presents the most general case: a set of management objects relating to generic applications whose object values can be determined from the computer system itself and do not require instrumentation within the application.

A finer-grained level of detail is planned for the future "appl MIB" which will be a common set of management objects relating to generic applications, but which require some type of instrumentation in the application in order to be determined. Since this new MIB module will provide a finer level of detail, any connection to the sysAppl MIB should be made by having pointers from this more detailed MIB back to the more generic sysAppl MIB. Likewise, as application-specific MIB modules such as the WWW MIB, etc., are developed over time, these more specific MIBs should reference back to the more generic MIBs.

While this MIB module does not attempt to provide every detailed piece of information for managing applications, it does provide a basic systems-level view of the applications and their components on a single host system.
5. The Structure of the MIB

The System Application MIB structure models application packages as a whole, and also models the individual elements (files and executables) which collectively form an application. The MIB is structured to model information regarding installed application packages and the elements which make up each application package. The MIB also models activity information on applications (and in turn, their components) that are running or have previously run on the host system. In modelling applications and their elements, this MIB module provides the necessary link for associating executing processes with the applications of which they are a part.

The objects are arranged into the following groups:

- System Application Installed Group
  - sysApplInstallPkgTable
  - sysApplInstallElmtTable

- System Application Run Group
  - sysApplRunTable
  - sysApplPastRunTable
  - sysApplElmtRunTable
  - sysApplElmtPastRunTable
  - (scalars for restricting table sizes)

As can be seen by the arrangement above, for each category, the MIB first treats an application package as a whole, and then breaks down the package to provide information about each of the elements (executable and non-executable files) of the package.

5.1. System Application Installed Group

The System Application Installed group consists of two tables. Through these two tables, administrators will be able to determine which applications have been installed on a system and what their constituent components are. The first table, the sysApplInstallPkgTable, lists the application packages installed on a particular host. The second, the sysApplInstallElmtTable, provides information regarding the
executables and non-executable files, or elements, which collectively compose an application.

NOTE: This MIB is intended to work with applications that have been installed on a particular host, where "installed" means that the existence of the application and the association between an application and its component files can be discovered without requiring additional instrumentation of the application itself. This may require that certain conventions be used, such as using a central software installation mechanism or registry, when installing application packages. For example, many UNIX systems utilize a "pkgadd" utility to track installed application packages, whilst many PC systems utilize a global registry.

5.2. System Application Run Group

This group models activity information for applications that have been invoked and are either currently running, or have previously run, on the host system. Likewise, the individual elements of an invoked application are also modeled to show currently running processes, and processes that have run in the past. This information is modeled using two pairs of tables: a pair of tables for currently running applications and past run applications, and a pair of tables for the currently running elements and the past run elements. Seven scalars are also defined to control the size of the past run tables.

5.2.1. sysApplRunTable and sysApplPastRunTable

The sysApplRunTable and the sysApplPastRunTable make up the first pair of tables. The sysApplRunTable contains the application instances which are currently running on the host. Each time an application is invoked, a new entry is created in the sysApplRunTable to provide information about that particular invocation of the application. An entry will remain in this table until the application instance terminates, at which time the entry will be deleted from the sysApplRunTable and placed in the sysApplPastRunTable.

The sysApplPastRunTable maintains a history of instances of
applications which have previously executed on the host. Entries to this table are made when an invoked application from the sysApplRunTable terminates; the table entry which represents the application instance is removed from the SysApplRunTable and is added to the sysApplPastRunTable.

Because the sysApplPastRunTable will continuously grow as applications are executed and terminate, two scalars are defined to control the ageing-out of table entries. The value of sysApplPastRunMaxRows specifies the maximum number of entries the table may contain, whilst the sysApplPastRunTblTimeLimit specifies the maximum age of the table entries. Oldest entries are removed first.

It is important to note that the sysApplRunTable and sysApplPastRunTable contain entries for each INVOCATION of an application. A single application package might be invoked multiple times; each invocation is properly recorded by a separate entry in the sysApplRunTable.

In order to implement this group, the agent must be able to recognize that an application has been invoked, and be able to determine when that invocation terminates. This poses a complex problem since a single application invocation may involve numerous processes, some of which may be required to remain running throughout the duration of the application, others which might come and go. The sysApplInstallElmtRole columnar object in the sysApplInstallElmtTable is meant to assist in this task by indicating which elements must be running in order for the application to be running, which elements are dependent on required elements, etc. See the description of sysApplInstallElmtRole for more details.

5.2.2. sysApplElmtRunTable and sysApplElmtPastRunTable

While the sysApplRunTable and sysApplPastRunTable focus on applications as a whole, the sysApplElmtRunTable and sysApplElmtPastRunTable provide information regarding an application’s executable elements, (processes), which are either currently executing or have executed in the past.

The sysApplElmtRunTable contains an entry for every process
currently running on the host. An entry is created in this table for each instance of a process at the time it is started, and will remain in the table until the process terminates. Note that in order to provide complete information on load on the system, this table lists EVERY running process, not just those processes that are running as part of an identified application. However, when processes terminate, only those entries which are part of an identified application are moved to the sysAppElmtPastRunTable.

The sysAppElmtPastRunTable maintains a history of instances of processes which have previously executed on the host as part of an application. When a process from the sysAppElmtRunTable terminates, the entry is moved to this sysAppElmtPastRunTable provided that the process was part of an identified application. If the process cannot be associated to any ‘parent’ application, than it is simply removed from the sysAppElmtRunTable. This allows for processes like ‘ps’ or ‘grep’ to show up in the Running table, (where they are consuming resources and are thus, "interesting"), but not in the Past Run table.

Because the sysAppElmtPastRunTable will continuously grow as processes are executed and terminate, two scalars are defined to control the ageing-out of table entries. The value of sysAppElmtPastRunMaxRows specifies the maximum number of entries the table may contain, whilst the sysAppElmtPastRunTblTimeLimit specifies the maximum age of the table entries. Oldest entries are removed first.
6. Definitions

SYSAPPL-MIB DEFINITIONS ::= BEGIN

IMPORTS
  MODULE-IDENTITY, OBJECT-TYPE,
  Integer32, Unsigned32, TimeTicks, Counter32, Gauge32
  FROM SNMPv2-SMI
  DisplayString, DateAndTime, TEXTUAL-CONVENTION
  FROM SNMPv2-TC
  InternationalDisplayString
  FROM HOST-RESOURCES-MIB
  MODULE-COMPLIANCE, OBJECT-GROUP
  FROM SNMPv2-CONF
  mib-2 FROM RFC1213-MIB;

-- System Application MIB

sysApplMIB MODULE-IDENTITY
  LAST-UPDATED "9611250000Z"
  ORGANIZATION "IETF Applications MIB Working Group"
  CONTACT-INFO
  "Cheryl Krupczak (Editor, WG Advisor)
  Postal: Empire Technologies, Inc.
  541 Tenth Street NW
  Suite 169
  Atlanta, GA 30318
  USA
  Phone: (770) 384-0184
  Email: cheryl@empiretech.com

  Jon Saperia (WG Chair)
  Postal: BGS Systems, Inc.
  128 Technology Center
  Waltham, MA 02254-9111
  USA
  Phone: (617) 891-0000 ext 340
  Email: saperia@bgs.com

  Rick Sturm
  Postal: Enterprise Management Profession Services, Inc.
  345 Norton Street
  Boulder, CO 80303

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DESCRIPTION

"The MIB module defines management objects that model applications as collections of executables and files installed and executing on a host system. The MIB presents a system-level view of applications; i.e., objects in this MIB are restricted to those attributes that can be obtained from the system itself without adding special instrumentation to the applications."

::= { mib-2 9999 }

sysApplOBJ OBJECT IDENTIFIER ::= { sysApplMIB 1 }
sysApplInstalled OBJECT IDENTIFIER ::= { sysApplOBJ 1 }
sysApplRun OBJECT IDENTIFIER ::= { sysApplOBJ 2 }
sysApplNotifications OBJECT IDENTIFIER ::= { sysApplMIB 2 }
sysApplConformance OBJECT IDENTIFIER ::= { sysApplMIB 3 }

-- Textual Conventions

RunState ::= TEXTUAL-CONVENTION
STATUS current
DESCRIPTION
"This TC describes the current execution state of a running application or process."
SYNTAX INTEGER {
  running (1),
  runnable (2), -- waiting for resource (CPU, etc.)
  waiting (3), -- waiting for event
  exiting (4),
  other (5)  -- other invalid state
}

-- This MIB module makes use of the InternationalDisplayString
-- textual convention which is defined in the Host Resources MIB
-- as follows:

-- InternationalDisplayString ::= OCTET STRING
-- This data type is used to model textual information in some
-- character set. A network management station should use a local
-- algorithm to determine which character set is in use and how it
-- should be displayed. Note that this character set may be encoded
-- with more than one octet per symbol, but will most often be NVT
-- ASCII.

-- sysApplInstalled Group
-- This group provides information about application packages
-- that have been installed on the host computer. The group
-- contains two tables. The first, the sysApplInstallTable,
-- describes the application packages, the second, the
-- sysApplInstallElmtTable, describes the constituent elements
-- (files and executables) which compose an application package.
--
-- In order to appear in this group, an application and its
-- component files must be discoverable by the system itself,
-- possibly through some type of software installation mechanism
-- or registry.

-- sysApplInstallPkgTable
-- The system installed application packages table provides information
-- on the software packages loaded on a system. These packages may
-- consist of many different files including executable and
-- non-executable files.

sysApplInstallPkgTable OBJECT-TYPE
SYNTAX SEQUENCE OF SysApplInstallPkgEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The table listing the software application packages
    installed on a host computer. In order to appear in
    this table, it may be necessary for the application
to be installed using some type of software
installation mechanism or global registry so that its
existence can be detected by the agent implementation."
::= { sysApplInstalled 1 }

sysApplInstallPkgEntry OBJECT-TYPE
SYNTAX SysApplInstallPkgEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The logical row describing an installed application package."
INDEX { sysApplInstallPkgIndex }
::= { sysApplInstallPkgTable 1 }

SysApplInstallPkgEntry ::= SEQUENCE {
    sysApplInstallPkgIndex               Integer32,
    sysApplInstallPkgManufacturer        DisplayString,
    sysApplInstallPkgProductName         DisplayString,
    sysApplInstallPkgVersion             DisplayString,
    sysApplInstallPkgSerialNumber        DisplayString,
    sysApplInstallPkgDate                DateAndTime,
    sysApplInstallPkgLocation            InternationalDisplayString
}

sysApplInstallPkgIndex OBJECT-TYPE
SYNTAX   Integer32 (1..7fffffff'h)
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "An integer used only for indexing purposes. Generally monotonically increasing from 1 as new applications are installed.

The value for each installed application must remain constant at least from one re-initialization of the network management entity which implements this MIB module to the next re-initialization.

The specific value is meaningful only within a given SNMP entity. A sysApplInstallPkgIndex must not be re-used until the next agent entity restart in the event the installed application entry is deleted."
::= { sysApplInstallPkgEntry 1 }

sysApplInstallPkgManufacturer OBJECT-TYPE
SYNTAX   DisplayString
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The Manufacturer of the software application package."
::= { sysApplInstallPkgEntry 2 }
sysApplInstallPkgProductName OBJECT-TYPE
SYNTAX     DisplayString
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
   "The name provided to the software application package
by the Manufacturer."
 ::= { sysApplInstallPkgEntry 3 }

sysApplInstallPkgVersion OBJECT-TYPE
SYNTAX     DisplayString
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
   "The version number assigned to the application package
by the manufacturer of the software."
 ::= { sysApplInstallPkgEntry 4 }

sysApplInstallPkgSerialNumber OBJECT-TYPE
SYNTAX     DisplayString
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
   "The serial number of the software assigned by the
manufacturer."
 ::= { sysApplInstallPkgEntry 5 }

sysApplInstallPkgDate OBJECT-TYPE
SYNTAX     DateAndTime
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
   "The date and time this software application was installed
on the host."
 ::= { sysApplInstallPkgEntry 6 }

sysApplInstallPkgLocation OBJECT-TYPE
SYNTAX     InternationalDisplayString (SIZE (0..1024))
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
   "The complete path name where the application package
is installed. For example, the value would be
'/opt/MyapplDir' if the application package was installed
in the /opt/MyapplDir directory."
sysApplInstallElmtTable OBJECT-TYPE
SYNTAX SEQUENCE OF SysApplInstallElmtEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"This table details the individual application package elements (files and executables) which comprise the applications defined in the sysApplInstallPkg Table. Each entry in this table has an index to the sysApplInstallPkg table to identify the application package of which it is a part. As a result, there may be many entries in this table for each instance in the sysApplInstallPkg Table.

Table entries are indexed by sysApplInstallPkgIndex, sysApplInstallElmtIndex to facilitate retrieval of all elements associated with a particular installed application package."
::= { sysApplInstalled 2 }

SysApplInstallElmtEntry OBJECT-TYPE
SYNTAX SysApplInstallElmtEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The logical row describing an element of an installed application. The element may be an executable or non-executable file."
INDEX {sysApplInstallPkgIndex, sysApplInstallElmtIndex}
::= { sysApplInstallElmtTable 1 

SysApplInstallElmtEntry ::= SEQUENCE {
    sysApplInstallElmtIndex             Integer32,
    sysApplInstallElmtName              DisplayString,
    sysApplInstallElmtType              INTEGER,
    sysApplInstallElmtDate              DateAndTime,
    sysApplInstallElmtPath              InternationalDisplayString,
    sysApplInstallElmtSizeHigh          Unsigned32,
<table>
<thead>
<tr>
<th>Object Name</th>
<th>SYNTAX</th>
<th>MAX-ACCESS</th>
<th>STATUS</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>sysApplInstallElmtIndex</td>
<td>Integer32</td>
<td>not-accessible</td>
<td>current</td>
<td>&quot;An arbitrary integer used for indexing. The value of this index is unique among all rows in this table that exist or have existed since the last agent restart.&quot;</td>
</tr>
<tr>
<td>sysApplInstallElmtName</td>
<td>DisplayString</td>
<td>read-only</td>
<td>current</td>
<td>&quot;The name of this element which is contained in the application.&quot;</td>
</tr>
<tr>
<td>sysApplInstallElmtType</td>
<td>INTEGER</td>
<td>read-only</td>
<td>current</td>
<td>&quot;The type of element that is part of the installed application.&quot;</td>
</tr>
<tr>
<td>sysApplInstallElmtDate</td>
<td>DateAndTime</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MAX-ACCESS  read-only
STATUS current
DESCRIPTION
"The date and time that this component was installed on
the system."
::= { sysApplInstallElmtEntry 4 }

sysApplInstallElmtPath OBJECT-TYPE
SYNTAX   InternationalDisplayString (SIZE (0..1024))
MAX-ACCESS read-only
STATUS    current
DESCRIPTION
"The full directory path where this element is installed.
For example, the value would be '/opt/EMPuma/bin' for an
element installed in the directory '/opt/EMPuma/bin'."
::= { sysApplInstallElmtEntry 5 }

sysApplInstallElmtSizeHigh OBJECT-TYPE
SYNTAX   Unsigned32
MAX-ACCESS read-only
STATUS    current
DESCRIPTION
"The installed file size in 2^32 byte blocks. This is
the size of the file on disk immediately after installation.

For example, for a file with a total size of 4,294,967,296
bytes, this variable would have a value of 1; for a file
with a total size of 4,294,967,295 bytes this variable
would be 0."
::= { sysApplInstallElmtEntry 6 }

sysApplInstallElmtSizeLow OBJECT-TYPE
SYNTAX   Unsigned32
MAX-ACCESS read-only
STATUS    current
DESCRIPTION
"The installed file size modulo 2^32 bytes. This is
the size of the file on disk immediately after installation.

For example, for a file with a total size of 4,294,967,296
bytes this variable would have a value of 0; for a file with
a total size of 4,294,967,295 bytes this variable would be
4,294,967,295."
::= { sysApplInstallElmtEntry 7 }
sysApplInstallElmtRole OBJECT-TYPE
SYNTAX Bits {
    executable(0),
    -- An application may have one or
    -- more executable elements. The rest of the
    -- bits have no meaning if the element is not
    -- executable.
    exclusive(1),
    -- Only one copy of an exclusive element may be
    -- running per invocation of the running
    -- application.
    primary(2),
    -- The primary executable. The execution of
    -- this element constitutes an invocation of
    -- the application. This is used by the agent
    -- implementation to determine the initiation of
    -- an application.
    required(3),
    -- An application may have zero or more required
    -- elements. All required elements must be running
    -- in order for the application to be judged to be
    -- running and healthy.
    dependent(4),
    -- An application may have zero or more
    -- dependent elements. Dependent elements may
    -- not be running unless required elements are.
    unknown(5)
    -- Default value for the case when an operator
    -- has not yet assigned one of the other values.
}
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"An operator assigned value used in the determination of
application status. This value is used by the agent to
determine both the mapping of started processes to the
initiation of an application, as well as to allow for a
determination of application health."
::= { sysApplInstallElmtEntry 8 }

sysApplInstallElmtModifyDate OBJECT-TYPE
SYNTAX DateAndTime
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The date and time that this element was last modified. Modification of the sysApplInstallElmtRole columnar object does NOT constitute a modification of the element itself and should not effect the value of this object."

::= { sysApplInstallElmtEntry 9 }

sysApplInstallElmtCurSizeHigh OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The current file size in 2^32 byte blocks. For example, for a file with a total size of 4,294,967,296 bytes, this variable would have a value of 1; for a file with a total size of 4,294,967,295 bytes this variable would be 0."

::= { sysApplInstallElmtEntry 10 }

sysApplInstallElmtCurSizeLow OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The current file size modulo 2^32 bytes. For example, for a file with a total size of 4,294,967,296 bytes this variable would have a value of 0; for a file with a total size of 4,294,967,295 bytes this variable would be 4,294,967,295."

::= { sysApplInstallElmtEntry 11 }

-- sysApplRun Group
-- This group models activity information for applications
-- that have been invoked and are either currently running,
-- or have previously run on the host system. Likewise,
-- the individual elements of an invoked application are
-- also modeled to show currently running processes, and
-- processes that have run in the past.

-- sysApplRunTable
-- The sysApplRunTable contains the application instances
-- which are currently running on the host. Since a single
-- application might be invoked multiple times, an entry is
-- added to this table for each INVOCATION of an application.
-- The table is indexed by sysApplInstallPkgIndex, sysApplRunIndex
-- to enable managers to easily locate all invocations of
-- a particular application package.

sysApplRunTable OBJECT-TYPE
SYNTAX      SEQUENCE OF SysApplRunEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"The table describes the applications which are executing
on the host. Each time an application is invoked,
an entry is created in this table. When an application ends,
the entry is removed from this table and placed in the
SysApplPastRunTable.

The table is indexed by sysApplInstallPkgIndex,
sysApplRunIndex to enable managers to easily locate all
invocations of a particular application package."
::= { sysApplRun 1 }

sysApplRunEntry OBJECT-TYPE
SYNTAX      SysApplRunEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"The logical row describing an application which is
currently running on this host."
INDEX       { sysApplInstallPkgIndex, sysApplRunIndex }
::= { sysApplRunTable 1 }

SysApplRunEntry ::= SEQUENCE {
    sysApplRunIndex                         Integer32,
    sysApplRunStarted                       DateAndTime,
    sysApplRunCurrentState                  RunState
}

sysApplRunIndex OBJECT-TYPE
SYNTAX      Integer32 (1..’7fffffff’h)
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"Part of the index for this table. An arbitrary
integer used only for indexing purposes. Generally
monotonically increasing from 1 as new applications are
started on the host, it uniquely identifies application
invocations.

The numbering for this index increases by 1 for each INVOCATION of an application, regardless of which installed application package this entry represents a running instance of.

An example of the indexing for a couple of entries is shown below.

:  
  sysApplRunStarted.17.14
  sysApplRunStarted.17.63
  sysApplRunStarted.18.13
  :

In this example, the agent has observed 12 application invocations when the application represented by entry 18 in the sysApplInstallPkgTable is invoked. The next invocation detected by the agent is an invocation of installed application package 17. Some time later, installed application 17 is invoked a second time.

NOTE: this index is not intended to reflect a real-time (wall clock time) ordering of application invocations; it is merely intended to uniquely identify running instances of applications. Although the sysApplInstallPkgIndex is included in the INDEX clause for this table, it serves only to ease searching of this table by installed application and does not contribute to uniquely identifying table entries.

::= { sysApplRunEntry 1 }

sysApplRunStarted OBJECT-TYPE
SYNTAX     DateAndTime
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
  "The date and time that the application was started."
::= { sysApplRunEntry 2 }

sysApplRunCurrentState OBJECT-TYPE
SYNTAX     RunState
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The current state of the running application. The possible values are running(1), runnable(2) but waiting for a resource such as CPU, waiting(3) for an event, exiting(4), or other(5)."
 ::= { sysApplRunEntry 3 }

-- sysApplPastRunTable
-- The sysApplPastRunTable provides a history of applications previously run on the host computer. Entries are removed from the sysApplRunTable and moved to this table when an application becomes inactive. Entries remain in this table until they are aged out when either the table size reaches a maximum as determined by the sysApplPastRunMaxRows, or when an entry has aged to exceed a time limit as set by sysApplPastRunTblTimeLimit.
-- When aging out entries, the oldest entry, as determined by the value of sysApplPastRunTimeEnded, will be removed first.

sysApplPastRunTable OBJECT-TYPE
SYNTAX      SEQUENCE OF SysApplPastRunEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"A history of the applications that have previously run on the host computer. An entry is moved to this table from the sysApplRunTable when the invoked application represented by the entry ceases to be running.

Entries remain in this table until they are aged out when either the table size reaches a maximum as determined by the sysApplPastRunMaxRows, or when an entry has aged to exceed a time limit as set by sysApplPastRunTblTimeLimit.

Entries in this table are indexed by sysApplInstallPkgIndex, sysApplPastRunIndex to facilitate retrieval of all past run invocations of a particular installed application."
 ::= { sysApplRun 2 }

sysApplPastRunEntry OBJECT-TYPE
SYNTAX      SysApplPastRunEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"The logical row describing an invocation of an application which was previously run and has terminated. The entry is basically copied from the sysApplRunTable when the application instance terminates. Hence, the entry’s value for sysApplPastRunIndex is the same as its value was for sysApplRunIndex."

INDEX { sysApplInstallPkgIndex, sysApplPastRunIndex } ::= { sysApplPastRunTable 1 }

SysApplPastRunEntry ::= SEQUENCE {
    sysApplPastRunIndex                     Integer32,
    sysApplPastRunStarted                   DateAndTime,
    sysApplPastRunExitState                 INTEGER,
    sysApplPastRunTimeEnded                 DateAndTime
}

sysApplPastRunIndex OBJECT-TYPE
SYNTAX      Integer32 (1..7fffffff’h)
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"Part of the index for this table. An integer matching the value of the removed sysApplRunIndex corresponding to this row."
 ::= { sysApplPastRunEntry 1 }

sysApplPastRunStarted OBJECT-TYPE
SYNTAX      DateAndTime
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The date and time that the application was started."
 ::= { sysApplPastRunEntry 2 }

sysApplPastRunExitState OBJECT-TYPE
SYNTAX      INTEGER {
    complete (1), -- normal exit at sysApplRunTimeEnded
    failed (2),   -- abnormal exit
    other (3)
}
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The state of the application instance when it terminated."
::= { sysApplPastRunEntry 3 }

sysApplPastRunTimeEnded OBJECT-TYPE
SYNTAX      DateAndTime
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The DateAndTime the application instance was determined
to be no longer running."
::= { sysApplPastRunEntry 4 }

-- sysApplElmtRunTable
-- The sysApplElmtRunTable contains the process instances which
-- are currently running on the host. An entry is created in
-- this table for each instance of a process at the time it is
-- started, and will remain in the table until the process
-- terminates.
--
-- The table is indexed by sysApplElmtRunInvocID, sysApplElmtRunIndex
-- to make it easy to locate all running elements of a particular
-- invoked application.

sysApplElmtRunTable OBJECT-TYPE
SYNTAX      SEQUENCE OF SysApplElmtRunEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"The table describes the processes which are
currently executing on the host system. Each entry
represents a running process and is associated with
the invoked application of which it is a part, if
possible. Because a running application may involve
more than one executable, it is possible to have
multiple entries in this table for each application.
Entries are removed from this table when the process
terminates.

The table is indexed by sysApplElmtRunInvocID,
sysApplElmtRunIndex to make it easy to locate all running
elements of a particular invoked application."
::= { sysApplRun 3 }

sysApplElmtRunEntry OBJECT-TYPE
SYNTAX      SysApplElmtRunEntry
"The logical row describing a process currently running on this host. When possible, the entry is associated with the invoked application of which it is a part."

INDEX  { sysApplElmtRunInvocID, sysApplElmtRunIndex }
 ::= { sysApplElmtRunTable 1 }

SysApplElmtRunEntry ::= SEQUENCE {
  sysApplElmtRunInvocID           Integer32,
  sysApplElmtRunIndex             Integer32,
  sysApplElmtRunInstallID         Integer32,
  sysApplElmtRunTimeStarted       DateAndTime,
  sysApplElmtRunState             RunState,
  sysApplElmtRunName              InternationalDisplayString,
  sysApplElmtRunParameters        DisplayString,
  sysApplElmtRunCPU               TimeTicks,
  sysApplElmtRunMemory            Gauge32,
  sysApplElmtRunNumFiles          Gauge32,
  sysApplElmtRunUser              DisplayString
}

sysApplElmtRunInvocID OBJECT-TYPE
 SYNTAX      Integer32 (0..'7fffffff'h)
 MAX-ACCESS  not-accessible
 STATUS      current
 DESCRIPTION
 "Part of the index for this table, this value identifies the invocation of an application of which this process is a part. Provided that the ‘parent’ application can be determined, the value of this object is the same value as the sysApplRunIndex for the corresponding application invocation in the sysApplRunTable.

If, however, the ‘parent’ application cannot be determined, the value for this object is then ‘0’ signifying that this process cannot be related back to an invocation of an application in the sysApplRunTable."
 ::= { sysApplElmtRunEntry 1 }

sysApplElmtRunIndex OBJECT-TYPE
SYNTAX Integer32 (0..'7fffffff'h)
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Part of the index for this table. A unique value for each process running on the host. Whenever possible, this should be the system’s native, unique identification number."
::= { sysApplElmtRunEntry 2 }

sysApplElmtRunInstallID OBJECT-TYPE
SYNTAX Integer32 (0..'7fffffff'h)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The index into the sysApplInstallElmtTable. The value of this object is the same value as the sysApplInstallElmtIndex for the application element of which this entry represents a running instance. If this process cannot be associated to an installed executable, the value should be ‘0’.
::= { sysApplElmtRunEntry 3 }

sysApplElmtRunTimeStarted OBJECT-TYPE
SYNTAX DateAndTime
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The time the process was started."
::= { sysApplElmtRunEntry 4 }

sysApplElmtRunState OBJECT-TYPE
SYNTAX RunState
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The current state of the running process. The possible values are running(1), runnable(2) but waiting for a resource such as CPU, waiting(3) for an event, exiting(4), or other(5)."
::= { sysApplElmtRunEntry 5 }

sysApplElmtRunName OBJECT-TYPE
SYNTAX InternationalDisplayString (SIZE (0..1024))

Expires May 25, 1997
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The full path and filename of the process.
For example, '/opt/MYYpkg/bin/myyproc' would
be returned for process 'myyproc' whose execution
path is '/opt/MYYpkg/bin/myyproc'."
::= { sysApplElmtRunEntry 6 }

sysApplElmtRunParameters OBJECT-TYPE
SYNTAX      DisplayString
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The starting parameters for the process."
::= { sysApplElmtRunEntry 7 }

sysApplElmtRunCPU OBJECT-TYPE
SYNTAX      TimeTicks
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The number of centi-seconds of the total system’s
CPU resources consumed by this process. Note that
on a multi-processor system, this value may
increment by more than one centi-second in one
centi-second of real (wall clock) time."
::= { sysApplElmtRunEntry 8 }

sysApplElmtRunMemory OBJECT-TYPE
SYNTAX      Gauge32
UNITS       "Kbytes"
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The total amount of real system memory measured in
Kbytes currently allocated to this process."
::= { sysApplElmtRunEntry 9 }

sysApplElmtRunNumFiles OBJECT-TYPE
SYNTAX      Gauge32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The number of files currently open by the
process. Transport connections (sockets) should NOT be included in the calculation of this value."
::= { sysApplElmtRunEntry 10 }

sysApplElmtRunUser OBJECT-TYPE
SYNTAX DisplayString
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The process owner’s login name (e.g. root)."
::= { sysApplElmtRunEntry 11 }

-- sysApplElmtPastRunTable
-- The sysApplElmtPastRunTable maintains a history of
-- instances of processes which have previously executed on
-- the host as part of an application. Upon termination
-- of a process, an entry from the sysApplElmtRunTable is
-- moved to this table provided that the process was part of an
-- identified application.
--
-- Entries remain in this table until they are aged out when
-- either the number of entries in the table reaches a
-- maximum as determined by sysApplElmtPastRunMaxRows, or
-- when an entry has aged to exceed a time limit as set by
-- sysApplElmtPastRunTblTimeLimit. When aging out entries,
-- the oldest entry, as determined by the value of
-- sysApplElmtPastRunTimeEnded, will be removed first.
--
-- The table is indexed by sysApplElmtPastRunInvocID,
-- sysApplElmtPastRunIndex to make it easy to locate all
-- previously executed processes of a particular invoked application.

sysApplElmtPastRunTable OBJECT-TYPE
SYNTAX SEQUENCE OF SysApplElmtPastRunEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The table describes the processes which have previously executed on the host system as part of an application. Each entry represents a process which has previously executed and is associated with the invoked application of which it was a part. Because an invoked application may involve more than one executable, it is possible
to have multiple entries in this table for each application invocation. Entries are added to this table when the corresponding process in the sysApplElmtRun Table terminates.

Entries remain in this table until they are aged out when either the number of entries in the table reaches a maximum as determined by sysApplElmtPastRunMaxRows, or when an entry has aged to exceed a time limit as set by sysApplElmtPastRunTblTimeLimit. When aging out entries, the oldest entry, as determined by the value of sysApplElmtPastRunTimeEnded, will be removed first.

The table is indexed by sysApplElmtPastRunInvocID, sysApplElmtPastRunIndex to make it easy to locate all previously executed processes of a particular invoked application."

::= { sysApplRun 4 }

sysApplElmtPastRunEntry OBJECT-TYPE
SYNTAX SysApplElmtPastRunEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The logical row describing a process which was previously executed on this host as part of an application. The entry is basically copied from the sysApplElmtRunTable when the process terminates. Hence, the entry's value for sysApplElmtPastRunIndex is the same as its value was for sysApplElmtRunIndex. Only those processes which could be associated with an identified application are included in this table."
INDEX { sysApplElmtPastRunInvocID, sysApplElmtPastRunIndex }
::= { sysApplElmtPastRunTable 1 }

SysApplElmtPastRunEntry ::= SEQUENCE {
  sysApplElmtPastRunInvocID           Integer32,
  sysApplElmtPastRunIndex             Integer32,
  sysApplElmtPastRunInstallID         Integer32,
  sysApplElmtPastRunTimeStarted       DateAndTime,
  sysApplElmtPastRunTimeEnded         DateAndTime,
  sysApplElmtPastRunExitState         INTEGER,
  sysApplElmtPastRunName              InternationalDisplayString,
  sysApplElmtPastRunParameters        DisplayString,
sysApplElmtPastRunCPU TimeTicks,  
sysApplElmtPastRunMemory Integer32,  
sysApplElmtPastRunNumFiles Integer32,  
sysApplElmtPastRunUser DisplayString  
}

sysApplElmtPastRunInvocID OBJECT-TYPE  
SYNTAX Integer32 (1..'7fffffff'h)  
MAX-ACCESS not-accessible  
STATUS current  
DESCRIPTION  
"Part of the index for this table, this value  
identifies the invocation of an application of which  
the process represented by this entry was a part.  
The value of this object is the same value as the  
sysApplRunIndex for the corresponding application  
invocation in the sysApplRunTable. If the invoked  
application as a whole has terminated, it will be the  
same as the sysApplPastRunIndex."  
::= { sysApplElmtPastRunEntry 1 }

sysApplElmtPastRunIndex OBJECT-TYPE  
SYNTAX Integer32 (0..'7fffffff'h)  
MAX-ACCESS not-accessible  
STATUS current  
DESCRIPTION  
"Part of the index for this table. An integer  
assigned by the agent equal to the corresponding  
sysApplElmtRunIndex which was removed from the  
sysApplElmtRunTable and moved to this table  
when the element terminated.  

Note: entries in this table are indexed by  
sysApplElmtPastRunInvocID, sysApplElmtPastRunIndex.  
The possibility exists, though unlikely, of a  
collision occurring by a new entry which was run  
by the same invoked application (InvocID), and  
was assigned the same process identification number  
(ElmtRunIndex) as an element which was previously  
run by the same invoked application.  

Should this situation occur, the new entry replaces  
the old entry.  

See Section: ‘Implementation Issues - sysApplElmtPastRunTable
Entry Collisions’ for the conditions that would have to occur in order for a collision to occur.
::= { sysApplElmtPastRunEntry 2 }

sysApplElmtPastRunInstallID OBJECT-TYPE
SYNTAX      Integer32 (1.'7fffffff'h)
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The index into the installed element table. The value of this object is the same value as the sysApplInstallElmtIndex for the application element of which this entry represents a previously executed process."
::= { sysApplElmtPastRunEntry 3 }

sysApplElmtPastRunTimeStarted OBJECT-TYPE
SYNTAX      DateAndTime
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The time the process was started."
::= { sysApplElmtPastRunEntry 4 }

sysApplElmtPastRunTimeEnded OBJECT-TYPE
SYNTAX      DateAndTime
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The time the process ended."
::= { sysApplElmtPastRunEntry 5 }

sysApplElmtPastRunExitState OBJECT-TYPE
SYNTAX      INTEGER {
completed (1),
failed (2),
other (3)
}
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The state of the process when it exited."
::= { sysApplElmtPastRunEntry 6 }
sysApplElmtPastRunName OBJECT-TYPE
   SYNTAX InternationalDisplayString (SIZE (0..1024))
   MAX-ACCESS read-only
   STATUS current
   DESCRIPTION
   "The full path and filename of the process.
   For example, '/opt/MYYpkg/bin/myyproc' would
   be returned for process 'myyproc' whose execution
   path was '/opt/MYYpkg/bin/myyproc'."
   ::= { sysApplElmtPastRunEntry 7 }

sysApplElmtPastRunParameters OBJECT-TYPE
   SYNTAX    DisplayString
   MAX-ACCESS read-only
   STATUS    current
   DESCRIPTION
   "The starting parameters for the process."
   ::= { sysApplElmtPastRunEntry 8 }

sysApplElmtPastRunCPU OBJECT-TYPE
   SYNTAX    TimeTicks
   MAX-ACCESS read-only
   STATUS    current
   DESCRIPTION
   "The last known number of centi-seconds of the total
   system's CPU resources consumed by this process.
   Note that on a multi-processor system, this value may
   increment by more than one centi-second in one
   centi-second of real (wall clock) time."
   ::= { sysApplElmtPastRunEntry 9 }

sysApplElmtPastRunMemory OBJECT-TYPE
   SYNTAX    Integer32 (0..'7fffffff'h)
   UNITS     "Kbytes"
   MAX-ACCESS read-only
   STATUS    current
   DESCRIPTION
   "The last known total amount of real system memory
   measured in Kbytes allocated to this process before it
   terminated."
   ::= { sysApplElmtPastRunEntry 10 }

sysApplElmtPastRunNumFiles OBJECT-TYPE
   SYNTAX    Integer32 (0..'7fffffff'h)
   MAX-ACCESS read-only
STATUS current
DESCRIPTION "The last known number of files open by the process before it terminated. Transport connections (sockets) should NOT be included in the calculation of this value."
::= { sysApplElmtPastRunEntry 11 }

sysApplElmtPastRunUser OBJECT-TYPE
SYNTAX DisplayString
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The process owner’s login name (e.g. root)."
::= { sysApplElmtPastRunEntry 12 }

-- Additional Scalar objects to control table sizes

sysApplPastRunMaxRows OBJECT-TYPE
SYNTAX Integer32 (0..’7fffffff’h)
MAX-ACCESS read-write
STATUS current
DESCRIPTION "The maximum number of entries allowed in the sysApplPastRunTable. Once the number of rows in the sysApplPastRunTable reaches this value, the oldest entry must be aged out to make room for the new entry to be added. Entries will be removed on the basis of oldest sysApplPastRunTimeEnded value first."
DEFVAL { 500 }
::= { sysApplRun 5 }

sysApplPastRunTableRemItems OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "A counter of the number of entries removed from the sysApplPastRunTable because of table size limitations as set in sysApplPastRunMaxRows. This counter is the number of entries removed by the management subsystem which implements this MIB module since the last initialization of the management subsystem."
::= { sysApplRun 6 }
sysApplPastRunTblTimeLimit OBJECT-TYPE
SYNTAX      Integer32 (0..'7fffffff'h)
UNITS       "seconds"
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION
"The maximum time in seconds which an entry in the
sysApplPastRunTable may exist before it is removed.
Any entry that is older than this value will be
removed (aged out) from the table.

Note that an entry may be aged out prior to reaching
this time limit if it is the oldest entry in the
table and must be removed to make space for a new
entry so as not to exceed sysApplPastRunMaxRows."
DEFVAL      { 7200 }
::= { sysApplRun 7 }

sysApplElemPastRunMaxRows OBJECT-TYPE
SYNTAX      Integer32 (0..'7fffffff'h)
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION
"The maximum number of entries allowed in the
sysApplElmtPastRunTable. Once the number of rows in
the sysApplElmtPastRunTable reaches this value,
the oldest entry must be aged out to make room for the new
entry to be added. Entries will be removed on the basis
of oldest sysApplElmtPastRunTimeEnded value first."
DEFVAL      { 500 }
::= { sysApplRun 8 }

sysApplElemPastRunTableRemItems OBJECT-TYPE
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"A counter of entries removed by the agent during its
lifetime from the sysApplElemPastRunTable because of
table size limitations as set in sysApplElemPastRunMaxRows.
This counter is the number of entries removed by the
management subsystem implementing this MIB module since
the last initialization of the management subsystem."
::= { sysApplRun 9 }
sysApplElemPastRunTblTimeLimit OBJECT-TYPE
SYNTAX Integer32 (0..'7fffffff'h)
UNITS "seconds"
MAX-ACCESS read-write
STATUS current
DESCRIPTION "The maximum time in seconds which an entry in the
sysApplElemPastRunTable may exist before it is removed.
Any entry that is older than this value will be
removed (aged out) from the table.

Note that an entry may be aged out prior to reaching
this time limit if it is the oldest entry in the
table and must be removed to make space for a new
entry so as not to exceed sysApplElemPastRunMaxRows."
DEFVAL { 7200 }
::= { sysApplRun 10 }

sysApplAgentPollInterval  OBJECT-TYPE
SYNTAX Integer32 (0..'7fffffff'h)
UNITS "seconds"
MAX-ACCESS read-write
STATUS current
DESCRIPTION "The minimum interval in seconds that an agent
will poll the status of the managed resources.
A value of 0 indicates that there is no delay
in the passing of information from the managed
resources to the agent."
DEFVAL { 60 }
::= { sysApplRun 11 }

-- Conformance Macros

sysApplMIBCompliances  OBJECT IDENTIFIER ::= { sysApplConformance 1 }
sysApplMIBGroups       OBJECT IDENTIFIER ::= { sysApplConformance 2 }

sysApplMIBCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION "Describes the requirements for conformance to
the System Application MIB"
MODULE -- this module
  MANDATORY-GROUPS { sysApplInstalledGroup,
    sysApplRunGroup }
  ::= { sysApplMIBCompliances 1 }

sysApplInstalledGroup OBJECT-GROUP
  OBJECTS { sysApplInstallPkgManufacturer,
    sysApplInstallPkgProductName,
    sysApplInstallPkgVersion,
    sysApplInstallPkgSerialNumber,
    sysApplInstallPkgDate,
    sysApplInstallPkgLocation,
    sysApplInstallElmtName,
    sysApplInstallElmtType,
    sysApplInstallElmtDate,
    sysApplInstallElmtPath,
    sysApplInstallElmtSizeHigh,
    sysApplInstallElmtSizeLow,
    sysApplInstallElmtRole,
    sysApplInstallElmtModifyDate,
    sysApplInstallElmtCurSizeHigh,
    sysApplInstallElmtCurSizeLow }

STATUS current
DESCRIPTION
  "The system application installed group contains
  information about applications and their constituent
  components which have been installed on the host system."
  ::= { sysApplMIBGroups 1 }

sysApplRunGroup OBJECT-GROUP
  OBJECTS { sysApplRunStarted,
    sysApplRunCurrentState,
    sysApplPastRunStarted,
    sysApplPastRunExitState,
    sysApplPastRunTimeEnded,
    sysApplElmtRunInstallID,
    sysApplElmtRunTimeStarted,
    sysApplElmtRunState,
    sysApplElmtRunName,
    sysApplElmtRunParameters,
    sysApplElmtRunCPU,
    sysApplElmtRunMemory,
    sysApplElmtRunNumFiles,
    sysApplElmtRunUser,
    sysApplElmtPastRunInstallID,
    sysApplElmtPastRunTimeEnded,
    sysApplElmtPastRunName,
    sysApplElmtPastRunParameters,
    sysApplElmtPastRunCPU,
    sysApplElmtPastRunMemory,
    sysApplElmtPastRunNumFiles,
    sysApplElmtPastRunUser, }
sysApplElmtPastRunTimeStarted,
sysApplElmtPastRunTimeEnded,
sysApplElmtPastRunExitState,
sysApplElmtPastRunName,
sysApplElmtPastRunParameters,
sysApplElmtPastRunCPU,
sysApplElmtPastRunMemory,
sysApplElmtPastRunNumFiles,
sysApplElmtPastRunUser,
sysApplFastRunMaxRows,
sysApplFastRunTableRemItems,
sysApplFastRunTblTimeLimit,
sysApplElemPastRunMaxRows,
sysApplElemPastRunTableRemItems,
sysApplElemPastRunTblTimeLimit,
sysApplAgentPollInterval }

STATUS  current
DESCRIPTION
"The system application run group contains information about applications and associated elements which have run or are currently running on the host system."
::= { sysApplMIBGroups 2 }

END

7. Implementation Issues

This section discusses implementation issues that are important for both an agent developer, and a management application developer or user to understand with regards to this MIB module. Although this section does not attempt to prescribe a particular implementation strategy, it does attempt to recognize some of the real world limitations that could effect an implementation of this MIB module.

7.1. Implementation with Polling Agents

Implementations of the System Application MIB on popular operating systems might require some considerable processing power to obtain status information from the managed resources.
It might also be difficult to determine when an application or a process starts or finishes. Implementors of this MIB might therefore choose an implementation approach where the agent polls the managed resources at regular intervals. The information retrieved by every poll is used to update a cached version of this MIB maintained inside of the agent. SNMP requests are processed based on the information found in this MIB cache.

A scalar sysApplAgentPollInterval is defined to give the manager control over the polling frequency. There is a trade-off between the amount of resources consumed during every poll to update the MIB cache, and the accuracy of the information provided by the System Application MIB agent. A default value of 60 seconds is defined to keep the processing overhead low while providing usable information for long living processes. A manager is expected to adjust this value if for example more accurate information about short-lived applications or processes is needed, or if the amount of resources consumed by the agent is too high.

7.2. sysApplElmtPastRunTable Entry Collisions

The sysApplElmtPastRunTable maintains a history of instances of processes which have previously executed on the host as part of an application. Basically, an entry is moved from the sysApplElmtRunTable to this PastRun table when the process represented by the entry terminates.

The sysApplElmtPastRunTable is indexed by the tuple, (sysApplElmtPastRunInvocID, sysApplElmtPastRunIndex), where the first part identifies the application invocation of which the process was a part, and the second part identifies the process itself.

Recall that the sysApplElmtRunIndex represents the system’s unique identification number assigned to a running process and that this value is mapped to sysApplElmtPastRunIndex when the process terminates and the entry is move from the ElmtRun table to the ElmtPastRun table. Many systems re-use process ID numbers which are no longer assigned to running processes: typically, the process numbers wrap and the next available process number is used.
It is therefore possible for two entries in the sysAppElmtPastRun Table to have the same value for sysAppElmtPastRunIndex. For this reason, entries in the ElmtPastRun table are indexed by the tuple sysAppElmtPastRunInvocID, sysAppElmtPastRunIndex to reduce the chance of a collision by two past run elements with the same sysAppElmtPastRunIndex.

However, it is still possible, though unlikely, for a collision to occur if the following happens:

1) the invoked application (identified by InvocID), has an element which runs, terminates, and is moved into the sysAppElmtPastRun table (index: InvocID, RunIndex)

2) the numbers used for the system’s process identification numbering wrap

3) that same invoked application (same InvocID), has another element process run, AND that process is assigned the same identification number as one of the processes previously run by that invoked application (same RunIndex), and finally,

4) that element process terminates and is moved to the sysAppElmtPastRun table prior to the old, duplicate (InvocID, RunIndex) entry being aged out of the table by settings defined for sysAppElmtPastRunMaxRows and sysAppElmtPastRunTblTimeLimit.

In the event that a collision occurs, the new entry will replace the old entry.
8. Security Considerations

In order to implement this MIB, an agent must make certain management information available about various logical and physical entities within a managed system which may be considered sensitive in some network environments.

Therefore, a network administrator may wish to employ instance-level access control, and configure the access mechanism (i.e., community strings in SNMPv1 and SNMPv2C), such that certain instances within this MIB are excluded from particular MIB views.

9. Acknowledgements

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10. Editor’s Address

Cheryl Krupczak  
Empire Technologies, Inc.  
541 Tenth Street, NW Suite 169  
Atlanta, GA 30318  
Phone: 770.384.0184  
Email: cheryl@empiretech.com

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