

**Application Performance Measurement MIB  
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## **1. Abstract**

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in TCP/IP-based internets. In particular, it defines objects for measuring the application performance as experienced by end-users.

## **2. The SNMP Management Framework**

The SNMP Management Framework presently consists of five major components:

- o An overall architecture, described in [RFC 2571](#) [[1](#)].
- 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](#) [[2](#)], STD 16, [RFC 1212](#) [[3](#)] and [RFC 1215](#) [[4](#)]. The second version, called SMIV2, is described in STD 58, [RFC 2578](#) [[5](#)], [RFC 2579](#) [[6](#)] and [RFC 2580](#) [[7](#)].
- 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](#) [[8](#)]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in [RFC 1901](#) [[9](#)] and [RFC 1906](#) [[10](#)]. The third version of the message protocol is called SNMPv3 and described in [RFC 1906](#) [[10](#)], [RFC 2572](#) [[11](#)] and [RFC 2574](#) [[12](#)].
- o Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in STD 15, [RFC 1157](#) [[8](#)]. A second set of protocol operations and associated PDU formats is described in [RFC 1905](#) [[13](#)].
- o A set of fundamental applications described in [RFC 2573](#) [[14](#)] and the view-based access control mechanism described in [RFC 2575](#) [[15](#)].

A more detailed introduction to the current SNMP Management Framework can be found in [RFC 2570](#) [[22](#)].



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**

This document continues the architecture created in the RMON MIB [18] by providing analysis of application performance as experienced by end-users.

Application performance measurement measures the quality of service delivered to end-users by applications. With this perspective, a true end-to-end view of the IT infrastructure results, combining the performance of the application, desktop, network, and server, as well as any positive or negative interactions between these components.

Despite all the technically sophisticated ways in which networking and system resources can be measured, human end-users perceive only two things about an application: availability and responsiveness.

Availability - The percentage of the time that the application is ready to give a user service.

Responsiveness - The speed at which the application delivers the requested service.

A transaction is an action initiated by a user that starts and completes a distributed processing function. A transaction begins when a user initiates a request for service (i.e. pushing a submit button) and ends when the work is completed (i.e. information is provided or a confirmation is delivered). A transaction is the fundamental unit measured by the APM MIB.

Application protocols implement one of three different types of transactions: transaction-oriented, throughput-oriented, or streaming-oriented. While the availability metric is the same for all three types, the responsiveness metric varies:

Transaction-Oriented: These transactions have a fairly constant workload to perform for all transactions. The responsiveness metric for transaction-oriented protocols is application response time (from first request to final delivery of service) and is measured in tenth's of seconds. This is commonly referred to as end-user response time.

Throughput-Oriented: These transaction have widely varying workloads based on the nature of the client request. In



particular, throughput-oriented protocols vary widely in the amount of data that must be transported to satisfy the request. The responsiveness metric for throughput-oriented protocols is seconds per terabit. [Ref: 2Kbps= 500 Million, 1Gbps=1000]. The inverting of the popular bits per second is done so that for all responsiveness metrics, lower values are better.

Streaming-Oriented: These transactions deliver data at a constant metered rate of speed regardless of the responsiveness of the networking and computing infrastructure. This constant rate of speed is generally spec'ed to be below (sometimes well below) the nominal capability of the infrastructure. However, when the infrastructure's cannot deliver data at this speed, interruption of service or degradation of service can result. The responsiveness metric for streaming-oriented protocols is the ratio of time that the service is degraded or interrupted to the total service time. This metric is measured in parts per million.

### **3.1. Report Aggregation**

This MIB provides functions to aggregate measurements into higher level summaries.

Every transaction is identified by its protocol, server, and client and has an availability measure as well as a responsiveness measure. The appropriate responsiveness measure is context-sensitive depending on whether the protocol is transaction-oriented, throughput-oriented, or streaming-oriented. For example, in a 5 minute period several transactions might be recorded:

Protocol	Client	Server	Successful	Responsiveness
HTTP	Jim	Amazon	1	6 sec.
SAP/R3	Jane	SAP	1	17 sec.
HTTP	Joe	HR	0	-
FTP	Jim	ietf	1	47MspTb (212 Kbps)
HTTP	Joe	HR	1	25 sec.
RealVideo	Joe	CNN	1	100.0%
HTTP	Jane	HR	1	5 sec.

These transactions can be aggregated in several ways,





providing statistical summaries - for example summarizing all HTTP transactions, or all HTTP transactions to the HR Server. Note that data from different protocols may not be summarized because:

1. The performance characteristics of different protocols differ widely enough to render statistical analysis meaningless.
2. The responsiveness metrics of different protocols may be different, making a statistical analysis impossible.

Aggregating transactions collected over a period requires aggregation algorithms. Several are provided:

#### TransactionCount

The total number of transactions during this period

#### SuccessfulTransactions

The total number of transactions that were successful

#### ResponsivenessMean

The average of the responsiveness metric for all aggregated transactions that completed successfully

#### ResponsivenessMin

The minimum responsiveness metric for all aggregated transactions that completed successfully

#### ResponsivenessMax

The maximum responsiveness metric for all aggregated transactions that completed successfully

#### ResponsivenessBx

The count of successful transactions whose responsiveness metric fell into the range specified for Bx. There are 7 buckets specified. Because the performance of different protocols varies widely, the bucket ranges are specified separately for each protocol (in the protocolDirExtTable) so that they may be tuned to typical performance of each protocol.

For example, when aggregating the previous set of transactions by protocol we get (for simplicity the example only shows TransactionCount, SuccessfulTransactions, and ResponsivenessMean):



Protocol	Count	Successful	ResponsivenessMean
HTTP	4	3	12 sec.
SAP/R3	1	1	17 sec.
FTP	1	1	212 Kbps.
RealVideo	1	1	100.0%

There are four different types of aggregation.

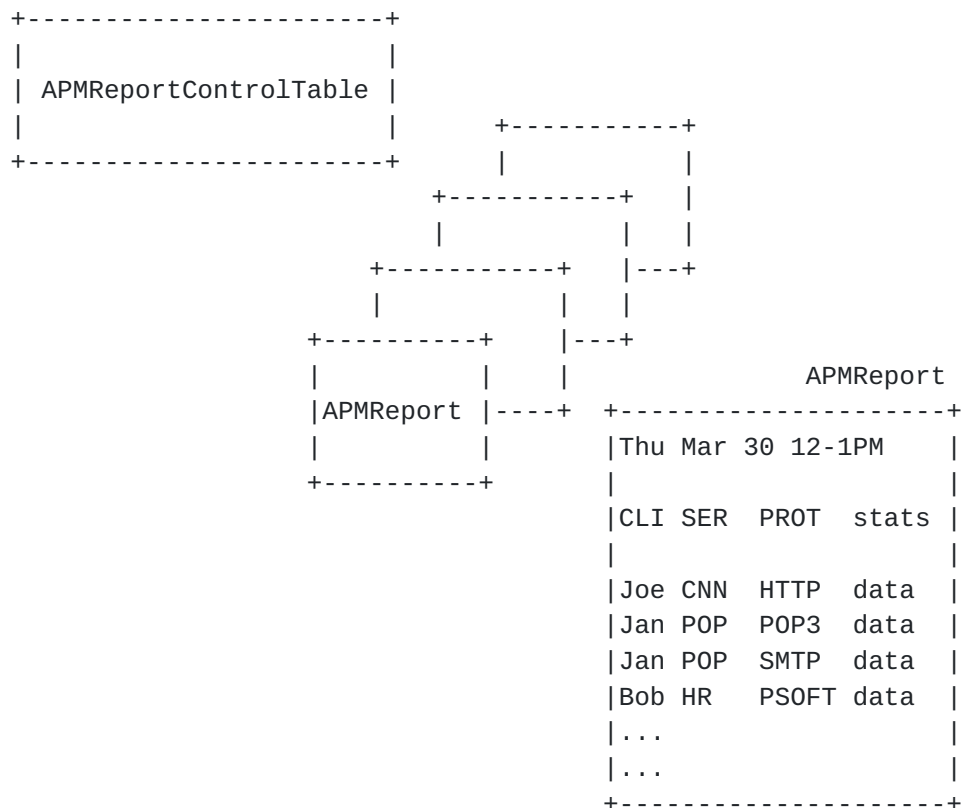
The flows(1) aggregation is the simplest. All transactions that share common protocol/server/client 3-tuples are aggregated together, resulting in a set of metrics for all such unique 3-tuples.

The clients(2) aggregation results in somewhat more aggregation (i.e. fewer resulting records). All transactions that share common protocol/client tuples are aggregated together, resulting in a set of metrics for all such unique tuples.

The servers(3) aggregation usually results in still more aggregation (i.e. fewer resulting records). All transactions that share common protocol/server tuples are aggregated together, resulting in a set of metrics for all such unique tuples.

The protocols(4) aggregation results in the most aggregation (i.e. the fewest resulting records). All transactions that share a common protocol are aggregated together, resulting in a set of metrics for all such unique protocols.







### **3.2. Structure of MIB**

The objects are arranged into the following groups:

- Protocol Directory Extensions Group
- APM Report Group

These groups are the basic unit of conformance. If an agent implements a group, then it must implement all objects in that group. While this section provides an overview of grouping and conformance information for this MIB, the authoritative reference for such information is contained in the MODULE-COMPLIANCE and OBJECT-GROUP macros later in this MIB.

These groups are defined to provide a means of assigning object identifiers, and to provide a method for implementors of managed agents to know which objects they must implement.

#### **3.2.1. The Protocol Directory Extensions Group**

The RMON2 protocol directory represents a useful registration mechanism for network protocols of all layers. For application protocols measured with this MIB, this group contains the additional configuration objects required. This group consists of the protocolDirExtTable.

#### **3.2.2. The APM Report Group**

The APM Report Group is used to prepare regular reports that aggregate application performance by flow, by client, by server, or by protocol. This group consists of the apmReportControlTable and the apmReportTable.

#### **3.2.3. The APM Current Transaction Group**

The APM Current Transaction Group is used to show the transactions that are currently in progress, along with their responsiveness metric.

Because many transactions last a very short time, they will exist in this table for a very short time. Thus, polling this table is not an effective mechanism for retrieving all transactions.





This table is designed to allow a management station to check on the status of long-lived transactions. Because the `apmReport` and `apmException` mechanisms act only on transactions that have finished, a network manager may not have visibility for some time into the performance of long-lived transactions such as streaming transactions, large data transfers, or (very) poorly performing transactions. In fact, by their very definition, the `apmReport` and `apmException` mechanisms only provide visibility into a problem after nothing can be done about it. The `apmCurrentTransactionTable` provides visibility into transactions that are currently executing and will allow a management station to find status of long-lived transactions.

#### **3.2.4. The APM Exception Group**

The APM Exception Group is used to generate immediate notifications of transactions that cross certain thresholds. The `apmExceptionTable` is used to configure which thresholds are to be checked for which types of transactions. The `apmTransactionResponsivenessAlarm` notification is sent when a transaction occurs with a responsiveness that crosses a threshold. The `apmTransactionUnsuccessfulAlarm` notification is sent when a transaction fails for which exception checking was configured.



#### 4. Definitions

APM-MIB DEFINITIONS ::= BEGIN

IMPORTS

MODULE-IDENTITY, OBJECT-TYPE,  
NOTIFICATION-TYPE,  
Counter32, Integer32 FROM SNMPv2-SMI  
RowStatus, TimeStamp FROM SNMPv2-TC  
MODULE-COMPLIANCE, OBJECT-GROUP,  
NOTIFICATION-GROUP FROM SNMPv2-CONF  
rmon, OwnerString FROM RMON-MIB  
DataSource,  
protocolDirID, protocolDirParameters,  
protocolDirLocalIndex FROM RMON2-MIB;

-- Application Performance Measurement MIB

apm MODULE-IDENTITY

LAST-UPDATED "200005071500Z" -- May 7, 2000

ORGANIZATION "IETF RMON MIB Working Group"

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DESCRIPTION

"The MIB module for measuring application performance  
as experienced by end-users. This MIB module  
augments the original RMON MIB as specified in  
[RFC 1757](#) and the RMON2 MIB as specified in [RFC 2021](#)."

REVISION "200003101500Z" -- May 7, 2000

DESCRIPTION

"The original version of this MIB, published as RFCXXXX."

::= { rmon 23 }

-- The protocol Directory Extensions Group

protocolDirExtTable OBJECT-TYPE

SYNTAX SEQUENCE OF ProtocolDirExtEntry

MAX-ACCESS not-accessible



STATUS current

DESCRIPTION

"The APM MIB extensions to the RMON2 Protocol Directory."

::= { apm 1 }

protocolDirExtEntry OBJECT-TYPE

SYNTAX ProtocolDirExtEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The APM MIB extensions to the RMON2 Protocol Directory. An entry will exist in this table for all application protocols for which application performance measuring is supported."

INDEX { protocolDirID, protocolDirParameters,  
protocolDirExtApmResponsivenessType }

::= { protocolDirExtTable 1 }

ProtocolDirExtEntry ::= SEQUENCE {

protocolDirExtApmResponsivenessType	INTEGER,
protocolDirExtApmConfig	INTEGER,
protocolDirExtApmResponsivenessBoundary1	Integer32,
protocolDirExtApmResponsivenessBoundary2	Integer32,
protocolDirExtApmResponsivenessBoundary3	Integer32,
protocolDirExtApmResponsivenessBoundary4	Integer32,
protocolDirExtApmResponsivenessBoundary5	Integer32,
protocolDirExtApmResponsivenessBoundary6	Integer32

}

protocolDirExtApmResponsivenessType OBJECT-TYPE

SYNTAX INTEGER {  
transactionOriented(1),  
transportOriented(2),  
streamingOriented(3)  
}

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This object describes and configures the agent's support for application performance measurement for this protocol. There are 3 types of measurements for different types of protocols:

Transaction-Oriented protocols have a fairly constant workload to perform for all transactions. The responsiveness metric for transaction-oriented protocols is application response time (from first request to final delivery of service) and is



measured in tenth's of seconds. This is commonly referred to as end-user response time.

Throughput-Oriented protocols have widely varying workloads based on the nature of the client request. In particular, throughput-oriented protocols vary widely in the amount of data that must be transported to satisfy the request. The responsiveness metric for throughput-oriented protocols is seconds per terabit. [Ref: 2Kbps= 500 Million, 1Gbps=1000]. The inverting of the popular bits per second is done so that for all responsiveness metrics, lower values are better.

Streaming-Oriented protocols deliver data at a constant metered rate of speed regardless of the responsiveness of the networking and computing infrastructure. This constant rate of speed is generally spec'ed to be below (sometimes well below) the nominal capability of the infrastructure. However, when the infrastructure's cannot deliver data at this speed, interruption of service or degradation of service can result. The responsiveness metric for streaming-oriented protocols is the ratio of time that the service is degraded or interrupted to the total service time. This metric is measured in parts per million.

Note that for some protocols, measuring more than one responsiveness type may be interesting. For agents that wish to support more than one measurement for a protocol, they will populate this table with 2 entries for that protocol, one for each type."

```
::= { protocolDirExtEntry 1 }
```

protocolDirExtApmConfig OBJECT-TYPE

```
SYNTAX      INTEGER {
                notSupported(1),
                supportedOff(2),
                supportedOn(3)
            }
```

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

```
STATUS      current
```

```
DESCRIPTION
```

"This object describes and configures support for application performance measurement for this protocol. When the agent creates entries in this table for all protocols that it understands, it will set the entry to notSupported(1) if it doesn't have the capability to measure application performance





for this protocol or if this protocol is not an application-level protocol.

If the value of this object is notSupported(1), the agent will not measure application performance metrics for this protocol and shall not allow this object to be changed to any other value. If the value of this object is supportedOn(3), the agent supports measurement of application performance metrics for this protocol and is configured to measure such metrics for all APM MIB functions and all interfaces.

If the value of this object is supportedOff(2), the agent supports measurement of application performance for this protocol but is configured to not measure these metrics for any APM MIB functions or interfaces.

Whenever this value changes from supportedOn(3) to supportedOff(2), the agent shall delete all related entries in all tables in this MIB."

::= { protocolDirExtEntry 2 }

protocolDirExtApmResponsivenessBoundary1 OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The boundary value between bucket1 and bucket 2. If this value is modified, all entries in the apmReportTable must be deleted."

::= { protocolDirExtEntry 3 }

protocolDirExtApmResponsivenessBoundary2 OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The boundary value between bucket2 and bucket 3. If this value is modified, all entries in the apmReportTable must be deleted."

::= { protocolDirExtEntry 4 }

protocolDirExtApmResponsivenessBoundary3 OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The boundary value between bucket3 and bucket 4. If this



value is modified, all entries in the apmReportTable must be deleted."

::= { protocolDirExtEntry 5 }

protocolDirExtApmResponsivenessBoundary4 OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The boundary value between bucket4 and bucket 5. If this value is modified, all entries in the apmReportTable must be deleted."

::= { protocolDirExtEntry 6 }

protocolDirExtApmResponsivenessBoundary5 OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The boundary value between bucket5 and bucket 6. If this value is modified, all entries in the apmReportTable must be deleted."

::= { protocolDirExtEntry 7 }

protocolDirExtApmResponsivenessBoundary6 OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The boundary value between bucket6 and bucket 7. If this value is modified, all entries in the apmReportTable must be deleted."

::= { protocolDirExtEntry 8 }



-- The APM Report Group

apmReportControlTable OBJECT-TYPE

SYNTAX SEQUENCE OF ApmReportControlEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Parameters that control the creation of a set of reports that  
aggregate application performance."

::= { apm 2 }

apmReportControlEntry OBJECT-TYPE

SYNTAX ApmReportControlEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A conceptual row in the apmReportControlTable.

An example of the indexing of this table is  
apmReportControlDuration.3"

INDEX { apmReportControlIndex }

::= { apmReportControlTable 1 }

ApmReportControlEntry ::= SEQUENCE {

apmReportControlIndex	Integer32,
apmReportControlDataSource	DataSource,
apmReportControlAggregationType	INTEGER,
apmReportControlInterval	Integer32,
apmReportControlRequestedSize	Integer32,
apmReportControlGrantedSize	Integer32,
apmReportControlRequestedReports	Integer32,
apmReportControlGrantedReports	Integer32,
apmReportControlStartTime	TimeStamp,
apmReportControlReportNumber	Integer32,
apmReportControlInsertsDenied	Integer32,
apmReportControlDroppedFrames	Counter32,
apmReportControlOwner	OwnerString,
apmReportControlStatus	RowStatus

}

apmReportControlIndex OBJECT-TYPE

SYNTAX Integer32 (1..65535)

MAX-ACCESS not-accessible

STATUS current



## DESCRIPTION

"An index that uniquely identifies an entry in the apmReportControlTable. Each such entry defines a unique report whose results are placed in the apmReportTable on behalf of this apmReportControlEntry."

::= { apmReportControlEntry 1 }

## apmReportControlDataSource OBJECT-TYPE

SYNTAX DataSource

MAX-ACCESS read-create

STATUS current

## DESCRIPTION

"The source of the data for APM Reports generated on behalf of this apmReportControlEntry."

This object may not be modified if the associated apmReportControlStatus object is equal to active(1)."

::= { apmReportControlEntry 2 }

## apmReportControlAggregationType OBJECT-TYPE

SYNTAX INTEGER {  
    flows(1),     -- Least Aggregation  
    clients(2),  
    servers(3),  
    protocols(4) -- Most Aggregation  
}

MAX-ACCESS read-create

STATUS current

## DESCRIPTION

"The type of aggregation being performed for this set of reports."

The metrics for a single transaction are the responsiveness of the transaction and whether the transaction succeeded (a boolean). When such metrics are aggregated in this MIB, these metrics are replaced by averages and distributions of responsiveness and availability. The metrics describing aggregates are constant no matter which type of aggregation is being performed. These metrics may be found in the apmReportTable.

The flows(1) aggregation is the simplest. All transactions that share common protocol/server/client 3-tuples are aggregated together, resulting in a set of metrics for all such unique 3-tuples.





The clients(2) aggregation results in somewhat more aggregation (i.e. fewer resulting records). All transactions that share common protocol/client tuples are aggregated together, resulting in a set of metrics for all such unique tuples.

The servers(3) aggregation usually results in still more aggregation (i.e. fewer resulting records). All transactions that share common protocol/server tuples are aggregated together, resulting in a set of metrics for all such unique tuples.

The protocols(4) aggregation results in the most aggregation (i.e. the fewest resulting records). All transactions that share a common protocol are aggregated together, resulting in a set of metrics for all such unique protocols.

Note that it is not meaningful to aggregate protocols, as different protocols have widely varying characteristics. As a result, this set of aggregations is complete.

This object may not be modified if the associated  
apmReportControlStatus object is equal to active(1)."  
::= { apmReportControlEntry 3 }

#### apmReportControlInterval OBJECT-TYPE

SYNTAX Integer32 (1..86400)

UNITS "Seconds"

MAX-ACCESS read-create

STATUS current

##### DESCRIPTION

"The interval in seconds over which data is accumulated before being aggregated into a report in the apmReportTable. All reports with the same apmReportControlIndex will be based on the same interval.

This object may not be modified if the associated  
apmReportControlStatus object is equal to active(1)."  
DEFVAL { 3600 }  
::= { apmReportControlEntry 4 }

#### apmReportControlRequestedSize OBJECT-TYPE

SYNTAX Integer32 (0..2147483647)

MAX-ACCESS read-create



STATUS current

DESCRIPTION

"The number of entries requested to be allocated for each report generated on behalf of this entry."

::= { apmReportControlEntry 5 }

apmReportControlGrantedSize OBJECT-TYPE

SYNTAX Integer32 (0..2147483647)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of entries per report the agent has allocated based on the requested amount in apmReportControlRequestedSize. Since multiple reports are saved, the total number of entries allocated will be this number multiplied by the value of apmReportControlGrantedReports, or 1 if that object doesn't exist.

When the associated apmReportControlRequestedSize object is created or modified, the agent should set this object as closely to the requested value as is possible for the particular implementation and available resources. When considering resources available, the agent must consider its ability to allocate this many entries for all reports.

Note that while the actual number of entries stored in the reports may fluctuate due to changing conditions, the agent must continue to have storage available to satisfy the full report size for all reports when necessary. Further, the agent must not lower this value except as a result of a set to the associated apmReportControlRequestedSize object."

::= { apmReportControlEntry 6 }

apmReportControlRequestedReports OBJECT-TYPE

SYNTAX Integer32 (0..65535)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The number of saved reports requested to be allocated on behalf of this entry."

::= { apmReportControlEntry 7 }

apmReportControlGrantedReports OBJECT-TYPE

SYNTAX Integer32 (0..65535)

MAX-ACCESS read-only



STATUS current

DESCRIPTION

"The number of saved reports the agent has allocated based on the requested amount in apmReportControlRequestedReports. Since each report can have many entries, the total number of entries allocated will be this number multiplied by the value of apmReportControlGrantedSize, or 1 if that object doesn't exist.

When the associated apmReportControlRequestedReports object is created or modified, the agent should set this object as closely to the requested value as is possible for the particular implementation and available resources. When considering resources available, the agent must consider its ability to allocate this many reports each with the number of entries represented by apmReportControlGrantedSize, or 1 if that object doesn't exist.

Note that while the storage required for each report may fluctuate due to changing conditions, the agent must continue to have storage available to satisfy the full report size for all reports when necessary. Further, the agent must not lower this value except as a result of a set to the associated apmReportControlRequestedSize object."

::= { apmReportControlEntry 8 }

apmReportControlStartTime OBJECT-TYPE

SYNTAX TimeStamp

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of sysUpTime when the system began processing the report in progress. Note that the report in progress is not available.

This object may be used by the management station to figure out the start time for all previous reports saved for this apmReportControlEntry, as reports are started at fixed intervals."

::= { apmReportControlEntry 9 }

apmReportControlReportNumber OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-only



STATUS current

DESCRIPTION

"The number of the report in progress. When an apmReportControlEntry is activated, the first report will be numbered zero."

::= { apmReportControlEntry 10 }

apmReportControlInsertsDenied OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of failed attempts to add an entry to reports for this apmReportControlEntry because the number of entries would have exceeded apmReportControlGrantedSize.

This number is valuable in determining if enough entries have been allocated for reports in light of fluctuating network usage. Note that an entry that is denied will often be attempted again, this number will not predict the exact number of additional entries needed, but can be used to understand the relative magnitude of the problem.

Also note that there is no ordering specified for the entries in the report, thus there are no rules for which entries will be omitted when not enough entries are available. As a consequence, the agent is not required to delete 'least valuable' entries first."

::= { apmReportControlEntry 11 }

apmReportControlDroppedFrames OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of frames which were received by the agent and therefore not accounted for in the \*StatsDropEvents, but for which the agent chose not to count for this entry for whatever reason. Most often, this event occurs when the agent is out of some resources and decides to shed load from this collection.

This count does not include packets that were not counted because they had MAC-layer errors.





Note that if the alMatrixTables are not implemented or are inactive because no protocols are enabled in the protocol directory, this value should be 0.

Note that, unlike the dropEvents counter, this number is the exact number of frames dropped."

::= { apmReportControlEntry 12 }

apmReportControlOwner OBJECT-TYPE

SYNTAX OwnerString

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The entity that configured this entry and is therefore using the resources assigned to it."

::= { apmReportControlEntry 13 }

apmReportControlStatus OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The status of this apmReportControlEntry.

An entry may not exist in the active state unless all objects in the entry have an appropriate value.

If this object is not equal to active(1), all associated entries in the apmReportTable shall be deleted by the agent."

::= { apmReportControlEntry 14 }

-- The APM Report Table

apmReportTable OBJECT-TYPE

SYNTAX SEQUENCE OF ApmReportEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The data resulting from aggregated APM reports. Consult the definition of apmReportControlAggregationType for the definition of the various types of aggregations."

::= { apm 3 }

apmReportEntry OBJECT-TYPE



SYNTAX       ApmReportEntry

MAX-ACCESS   not-accessible

STATUS       current

DESCRIPTION

"A conceptual row in the apmReportTable.

The apmReportControlIndex value in the index identifies the apmReportControlEntry on whose behalf this entry was created. The apmReportIndex value in the index identifies which report (in the series of reports) this entry is a part of.

The first protocolDirLocalIndex value in the index identifies the application layer protocol of the transactions aggregated in this entry.

The second protocolDirLocalIndex value in the index identifies the network layer protocol of the apmReportServerAddress and apmReportClientAddress. When the associated apmReportControlAggregationType value is equal to protocol(4), this value will equal 0.

The apmReportServerAddress value in the index identifies the network layer address of the server in transactions aggregated in this entry.

The apmReportClientAddress value in the index identifies the network layer address of the client in transactions aggregated in this entry.

The apmReportResponsivenessType value in the index identifies the type of responsiveness metric reported by this entry and uniquely identifies this entry when more than one responsiveness metric is measured for a flow.

Note that the order of protocolDirLocalIndex variables is the opposite of that in the RMON2 MIB (application.network instead of network.application) so that the report entries are sorted by application first, server second and client third.

An example of the indexing of this entry is

apmReportTransactionCount.3.15.34.18.4.128.2.6.7.4.128.2.6.6.1"

```
INDEX { apmReportControlIndex, apmReportIndex,  
        protocolDirLocalIndex, protocolDirLocalIndex,  
        apmReportServerAddress, apmReportClientAddress,  
        apmReportResponsivenessType }
```

```
::= { apmReportTable 1 }
```

ApmReportEntry ::= SEQUENCE {

apmReportIndex	Integer32,
apmReportServerAddress	OCTET STRING,



```
    apmReportClientAddress      OCTET STRING,
    apmReportResponsivenessType INTEGER,
    apmReportTransactionCount   Integer32,
    apmReportSuccessfulTransactions Integer32,
    apmReportResponsivenessMean Integer32,
    apmReportResponsivenessMin  Integer32,
    apmReportResponsivenessMax  Integer32,
    apmReportResponsivenessB1   Integer32,
    apmReportResponsivenessB2   Integer32,
    apmReportResponsivenessB3   Integer32,
    apmReportResponsivenessB4   Integer32,
    apmReportResponsivenessB5   Integer32,
    apmReportResponsivenessB6   Integer32,
    apmReportResponsivenessB7   Integer32
}
```

apmReportIndex OBJECT-TYPE

SYNTAX Integer32 (0..2147483647)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of apmReportControlReportNumber for the report to which this entry belongs."

::= { apmReportEntry 1 }

apmReportServerAddress OBJECT-TYPE

SYNTAX OCTET STRING

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The network server address for this apmReportEntry.

This is represented as an octet string with specific semantics and length as identified by the second protocolDirLocalIndex component of the index.

For example, if the protocolDirLocalIndex indicates an encapsulation of ip, this object is encoded as a length octet of 4, followed by the 4 octets of the ip address, in network byte order.

If the associated apmReportControlAggregationType is equal to protocol(4) or client(2), then this object will be encoded simply as a length octet of 0."

::= { apmReportEntry 2 }



**apmReportClientAddress OBJECT-TYPE**

SYNTAX OCTET STRING

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The network client address for this apmReportEntry.

This is represented as an octet string with specific semantics and length as identified by the second protocolDirLocalIndex component of the index.

For example, if the protocolDirLocalIndex indicates an encapsulation of ip, this object is encoded as a length octet of 4, followed by the 4 octets of the ip address, in network byte order.

If the associated apmReportControlAggregationType is equal to protocol(4) or server(3), then this object will be encoded simply as a length octet of 0."

::= { apmReportEntry 3 }

**apmReportResponsivenessType OBJECT-TYPE**SYNTAX INTEGER {  
transactionOriented(1),  
transportOriented(2),  
streamingOriented(3)  
}

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The type of measurement that this entry represents. Entries will only exist for measurements configured by the protocolDirExtApmResponsivenessType object."

::= { apmReportEntry 5 }

**apmReportTransactionCount OBJECT-TYPE**

SYNTAX Integer32

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The total number of transactions aggregated into this record."

::= { apmReportEntry 6 }

**apmReportSuccessfulTransactions OBJECT-TYPE**

SYNTAX Integer32





```
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
    "The total number of successful transactions aggregated into
    this record."
::= { apmReportEntry 7 }
```

apmReportResponsivenessMean OBJECT-TYPE

```
SYNTAX        Integer32
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
    "The arithmetic mean of the responsiveness metrics for all
    transactions aggregated into this record."
::= { apmReportEntry 8 }
```

apmReportResponsivenessMin OBJECT-TYPE

```
SYNTAX        Integer32
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
    "The minimum of the responsiveness metrics for all
    transactions aggregated into this record."
::= { apmReportEntry 9 }
```

apmReportResponsivenessMax OBJECT-TYPE

```
SYNTAX        Integer32
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
    "The maximum of the responsiveness metrics for all
    transactions aggregated into this record."
::= { apmReportEntry 10 }
```

apmReportResponsivenessB1 OBJECT-TYPE

```
SYNTAX        Integer32
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
    "The number of transactions aggregated into this record whose
    responsiveness was less than boundary1 value for this
    protocol."
::= { apmReportEntry 11 }
```



## apmReportResponsivenessB2 OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The number of transactions aggregated into this record whose responsiveness was greater than or equal to the boundary1 value for this protocol and less than the boundary2 value for this protocol."

::= { apmReportEntry 12 }

## apmReportResponsivenessB3 OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The number of transactions aggregated into this record whose responsiveness was greater than or equal to the boundary2 value for this protocol and less than the boundary3 value for this protocol."

::= { apmReportEntry 13 }

## apmReportResponsivenessB4 OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The number of transactions aggregated into this record whose responsiveness was greater than or equal to the boundary3 value for this protocol and less than the boundary4 value for this protocol."

::= { apmReportEntry 14 }

## apmReportResponsivenessB5 OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The number of transactions aggregated into this record whose responsiveness was greater than or equal to the boundary4 value for this protocol and less than the boundary5 value for this protocol."

::= { apmReportEntry 15 }

## apmReportResponsivenessB6 OBJECT-TYPE



SYNTAX       Integer32  
MAX-ACCESS   read-only  
STATUS       current  
DESCRIPTION  
    "The number of transactions aggregated into this record whose  
    responsiveness was greater than or equal to the boundary5  
    value for this protocol and less than the boundary6 value for  
    this protocol."  
 ::= { apmReportEntry 16 }

apmReportResponsivenessB7 OBJECT-TYPE

SYNTAX       Integer32  
MAX-ACCESS   read-only  
STATUS       current  
DESCRIPTION  
    "The number of transactions aggregated into this record whose  
    responsiveness was greater than or equal to the boundary6  
    value for this protocol."  
 ::= { apmReportEntry 17 }

-- APM Current Transaction Table

apmCurrentTable OBJECT-TYPE

SYNTAX       SEQUENCE OF ApmCurrentEntry  
MAX-ACCESS   not-accessible  
STATUS       current  
DESCRIPTION  
    "This table contains all transactions that have been started  
    but have not yet finished."  
 ::= { apm 4 }

apmCurrentEntry OBJECT-TYPE

SYNTAX       ApmCurrentEntry  
MAX-ACCESS   not-accessible  
STATUS       current  
DESCRIPTION  
    "A conceptual row in the apmCurrentTable.

The first protocolDirLocalIndex value in the index identifies  
the application layer protocol of the transactions represented  
by this entry.

The second protocolDirLocalIndex value in the index identifies  
the network layer protocol of the apmCurrentServerAddress and  
apmCurrentClientAddress.

The apmCurrentServerAddress value in the index identifies the



network layer address of the server in the transaction represented by this entry.

The apmCurrentClientAddress value in the index identifies the network layer address of the client in the transaction represented by this entry.

The apmCurrentResponsivenessType value in the index identifies the type of responsiveness metric reported by this entry and uniquely identifies this entry when more than one responsiveness metric is measured for a transaction.

Note that the order of protocolDirLocalIndex variables is the opposite of that in the RMON2 MIB (application.network instead of network.application) so that the report entries are sorted by application first, server second and client third.

An example of the indexing of this entry is

```
apmCurrentTransactionCount.34.18.4.128.2.6.7.4.128.2.6.6.23698.1"
```

```
INDEX { protocolDirLocalIndex, protocolDirLocalIndex,
        apmCurrentServerAddress, apmCurrentClientAddress,
        apmCurrentTransactionID,
        apmCurrentResponsivenessType }
 ::= { apmCurrentTable 1 }
```

```
ApmCurrentEntry ::= SEQUENCE {
    apmCurrentServerAddress      OCTET STRING,
    apmCurrentClientAddress      OCTET STRING,
    apmCurrentTransactionID      Integer32,
    apmCurrentResponsivenessType INTEGER,
    apmCurrentResponsiveness     Integer32,
    apmCurrentSuccess            INTEGER
}
```

apmCurrentServerAddress OBJECT-TYPE

SYNTAX OCTET STRING

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The network server address for this apmCurrentEntry.

This is represented as an octet string with specific semantics and length as identified by the second protocolDirLocalIndex component of the index.

For example, if the protocolDirLocalIndex indicates an encapsulation of ip, this object is encoded as a length





octet of 4, followed by the 4 octets of the ip address,  
in network byte order."  
::= { apmCurrentEntry 1 }

apmCurrentClientAddress OBJECT-TYPE

SYNTAX OCTET STRING

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The network client address for this apmCurrentEntry.

This is represented as an octet string with  
specific semantics and length as identified  
by the second protocolDirLocalIndex component of the index.

For example, if the protocolDirLocalIndex indicates an  
encapsulation of ip, this object is encoded as a length  
octet of 4, followed by the 4 octets of the ip address,  
in network byte order."

::= { apmCurrentEntry 2 }

apmCurrentTransactionID OBJECT-TYPE

SYNTAX Integer32 (0..2147483647)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A unique value for this transaction amongst other  
transactions sharing the same application layer protocol and  
server and client addresses. Implementations may choose to use  
the value of the client's source port, when possible."

::= { apmCurrentEntry 3 }

apmCurrentResponsivenessType OBJECT-TYPE

SYNTAX INTEGER {  
transactionOriented(1),  
transportOriented(2),  
streamingOriented(3)  
}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The type of measurement that this entry represents. Entries  
will only exist for measurements configured by the  
protocolDirExtApmResponsivenessType object."

::= { apmCurrentEntry 4 }



**apmCurrentResponsiveness OBJECT-TYPE**

SYNTAX Integer32

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The current value of the responsiveness metric for this transaction.

Note that this value may change over the lifetime of the transaction and it is the final value of this metric that is recorded as the responsiveness of the transaction for use in other APM MIB functions."

::= { apmCurrentEntry 5 }

**apmCurrentSuccess OBJECT-TYPE**SYNTAX INTEGER {  
                    successful(1),  
                    failed(2)  
                  }

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The success of this transaction up to this time. A transaction that has failed may exist in this table until it is closed. Once a transaction has been marked as failed, it cannot move back into the successful state.

Note that this value may change over the lifetime of the transaction and it is the final value of this metric that is recorded as the success of the transaction for use in other APM MIB functions."

::= { apmCurrentEntry 6 }

-- The APM exception table

**apmExceptionTable OBJECT-TYPE**

SYNTAX SEQUENCE OF ApmExceptionEntry

MAX-ACCESS not-accessible

STATUS current

## DESCRIPTION

"This table creates filters so that a management station can get immediate notification of a transaction that has had poor availability or responsiveness.

Each apmExceptionEntry is associated with a particular type of



transaction and is applied to all transactions of that type. Multiple apmExceptionEntries may be associated with a particular type of transaction. A transaction type is identified by the combination of protocolDirID and protocolDirParameters specified in the index of the apmExceptionEntry.

Because the quality of a transaction is not known until it is completed, these thresholds are only applied after the transaction has completed."

::= { apm 5 }

#### apmExceptionEntry OBJECT-TYPE

SYNTAX ApmExceptionEntry

MAX-ACCESS not-accessible

STATUS current

#### DESCRIPTION

"A conceptual row in the apmExceptionTable."

INDEX { protocolDirID, protocolDirParameters,  
protocolDirExtApmResponsivenessType, apmExceptionIndex }

::= { apmExceptionTable 1 }

ApmExceptionEntry ::= SEQUENCE {

apmExceptionIndex	Integer32,
apmExceptionResponsivenessComparison	INTEGER,
apmExceptionResponsivenessThreshold	Integer32,
apmExceptionUnsuccessfulException	INTEGER,
apmExceptionOwner	OwnerString,
apmExceptionStatus	RowStatus

}

#### apmExceptionIndex OBJECT-TYPE

SYNTAX Integer32 (1..65535)

MAX-ACCESS not-accessible

STATUS current

#### DESCRIPTION

"An index that uniquely identifies an entry in the apmExceptionTable. Each such entry sets up thresholds for a particular measurement of a particular protocol.

Note that even though the index of the apmExceptionTable contains other objects (e.g. protocolDirID) that may disambiguate apmExceptionEntries, no two apmExceptionEntries may have the same value of apmExceptionIndex."

::= { apmExceptionEntry 1 }



## apmExceptionResponsivenessComparison OBJECT-TYPE

```
SYNTAX      INTEGER {
                none(1),
                greater(2),
                less(3)
            }
```

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

```
STATUS      current
```

## DESCRIPTION

"If this value is greater(2) or less(3), the associated apmExceptionResponsivenessThreshold will be compared to this value and an exception will be created if the responsiveness is greater than the threshold (greater(2)) or less than the threshold (less(3))."

```
::= { apmExceptionEntry 2 }
```

## apmExceptionResponsivenessThreshold OBJECT-TYPE

```
SYNTAX      Integer32
```

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

```
STATUS      current
```

## DESCRIPTION

"The threshold that responsiveness metrics are compared to."

```
::= { apmExceptionEntry 3 }
```

## apmExceptionUnsuccessfulException OBJECT-TYPE

```
SYNTAX      INTEGER {
                off(1),
                on(2)
            }
```

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

```
STATUS      current
```

## DESCRIPTION

"If this value is on(2), an exception will be created if "

```
::= { apmExceptionEntry 4 }
```

## apmExceptionOwner OBJECT-TYPE

```
SYNTAX      OwnerString
```

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

```
STATUS      current
```

## DESCRIPTION

"The entity that configured this entry and is therefore using the resources assigned to it."

```
::= { apmExceptionEntry 5 }
```

## apmExceptionStatus OBJECT-TYPE





```
SYNTAX      RowStatus
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
    "The status of this apmExceptionEntry."
 ::= { apmExceptionEntry 6 }
```

-- APM Notifications

```
apmNotifications OBJECT IDENTIFIER ::= { apm 6 }
```

```
apmTransactionResponsivenessAlarm NOTIFICATION-TYPE
    OBJECTS      { apmExceptionResponsivenessThreshold,
                    apmCurrentResponsiveness }
    STATUS      current
    DESCRIPTION
        "Notification sent when a transaction exceeds a threshold
         defined in the apmException table. The index of the
         included apmExceptionResponsivenessThreshold object identifies
         the apmExceptionEntry that specified the threshold. The
         apmCurrentResponsiveness variable identifies the actual
         transaction and its responsiveness."
 ::= { apmNotifications 1 }
```

```
apmTransactionUnsuccessfulAlarm NOTIFICATION-TYPE
    OBJECTS      { apmExceptionResponsivenessThreshold }
    STATUS      current
    DESCRIPTION
        "Notification sent when a transaction is unsuccessful.
         The index of the included apmExceptionResponsivenessThreshold
         object identifies both the type of the transaction that caused
         this notification as well as the apmExceptionEntry that
         specified the threshold."
 ::= { apmNotifications 2 }
```

```
rmonConformance    OBJECT IDENTIFIER ::= { rmon 20 }
apmCompliances      OBJECT IDENTIFIER ::= { rmonConformance 11 }
apmGroups           OBJECT IDENTIFIER ::= { rmonConformance 12 }
```

apmCompliance MODULE-COMPLIANCE

```
STATUS  current
DESCRIPTION
    "Describes the requirements for conformance to
```



```
the APM MIB"
MODULE -- this module
    MANDATORY-GROUPS { protocolDirectoryExtensionsGroup,
                        apmReportGroup }
    ::= { apmCompliances 1 }

protocolDirectoryExtensionsGroup OBJECT-GROUP
    OBJECTS { protocolDirExtApmConfig,
               protocolDirExtApmResponsivenessBoundary1,
               protocolDirExtApmResponsivenessBoundary2,
               protocolDirExtApmResponsivenessBoundary3,
               protocolDirExtApmResponsivenessBoundary4,
               protocolDirExtApmResponsivenessBoundary5,
               protocolDirExtApmResponsivenessBoundary6 }
    STATUS current
    DESCRIPTION
        "The APM MIB extensions to the RMON2 Protocol Directory."
    ::= { apmGroups 1 }

apmReportGroup OBJECT-GROUP
    OBJECTS { apmReportControlDataSource,
               apmReportControlAggregationType,
               apmReportControlInterval,
               apmReportControlRequestedSize,
               apmReportControlGrantedSize,
               apmReportControlRequestedReports,
               apmReportControlGrantedReports,
               apmReportControlStartTime,
               apmReportControlReportNumber,
               apmReportControlInsertsDenied,
               apmReportControlDroppedFrames,
               apmReportControlOwner,
               apmReportControlStatus,
               apmReportIndex,
               apmReportServerAddress,
               apmReportClientAddress,
               apmReportResponsivenessType,
               apmReportTransactionCount,
               apmReportSuccessfulTransactions,
               apmReportResponsivenessMean,
               apmReportResponsivenessMin,
               apmReportResponsivenessMax,
               apmReportResponsivenessB1,
               apmReportResponsivenessB2,
               apmReportResponsivenessB3,
```



```
    apmReportResponsivenessB4,  
    apmReportResponsivenessB5,  
    apmReportResponsivenessB6,  
    apmReportResponsivenessB7 }
```

STATUS current

DESCRIPTION

"The apm report group controls the creation and retrieval of reports that aggregate application performance."

::= { apmGroups 2 }

apmCurrentTransactionGroup OBJECT-GROUP

```
OBJECTS { apmCurrentServerAddress,  
          apmCurrentClientAddress,  
          apmCurrentTransactionID,  
          apmCurrentResponsivenessType,  
          apmCurrentResponsiveness,  
          apmCurrentSuccess }
```

STATUS current

DESCRIPTION

"The apm current transaction group contains statistics for transactions that have not yet terminated."

::= { apmGroups 3 }

apmExceptionGroup OBJECT-GROUP

```
OBJECTS { apmExceptionResponsivenessComparison,  
          apmExceptionResponsivenessThreshold,  
          apmExceptionUnsuccessfulException,  
          apmExceptionOwner,  
          apmExceptionStatus }
```

STATUS current

DESCRIPTION

"The apm exception group causes notifications to be sent whenever transactions are detected that had poor availability or responsiveness."

::= { apmGroups 4 }

apmNotificationGroup NOTIFICATION-GROUP

```
NOTIFICATIONS { apmTransactionResponsivenessAlarm,  
                apmTransactionUnsuccessfulAlarm }
```

STATUS current

DESCRIPTION

"Notifications sent by an APM MIB agent."

::= { apmGroups 5 }

END



## 5. Security Considerations

This MIB contains network addresses, protocol usage information, and conversation statistics. Data of this nature may be considered sensitive in some environments. In such environments the administrator may wish to restrict SNMP access to the agent.

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 implementors consider the security features as provided by the SNMPv3 framework. Specifically, the use of the User-based Security Model [RFC 2574](#) [12] and the View-based Access Control Model [RFC 2575](#) [15] 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.





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## Table of Contents

<a href="#">1</a>	Abstract .....	<a href="#">2</a>
<a href="#">2</a>	The SNMP Management Framework .....	<a href="#">2</a>
<a href="#">3</a>	Overview .....	<a href="#">4</a>
<a href="#">3.1</a>	Report Aggregation .....	<a href="#">5</a>
<a href="#">3.2</a>	Structure of MIB .....	<a href="#">9</a>
<a href="#">3.2.1</a>	The Protocol Directory Extensions Group .....	<a href="#">9</a>
<a href="#">3.2.2</a>	The APM Report Group .....	<a href="#">9</a>
<a href="#">3.2.3</a>	The APM Current Transaction Group .....	<a href="#">9</a>
<a href="#">3.2.4</a>	The APM Exception Group .....	<a href="#">10</a>
<a href="#">4</a>	Definitions .....	<a href="#">11</a>
<a href="#">5</a>	Security Considerations .....	<a href="#">37</a>
<a href="#">6</a>	References .....	<a href="#">38</a>
<a href="#">7</a>	Intellectual Property .....	<a href="#">40</a>
<a href="#">8</a>	Full Copyright Statement .....	<a href="#">40</a>