

RECOMMENDATION ITU-R S.1251

**NETWORK MANAGEMENT – PERFORMANCE MANAGEMENT OBJECT CLASS
DEFINITIONS FOR SATELLITE SYSTEMS NETWORK ELEMENTS
FORMING PART OF SDH TRANSPORT NETWORKS
IN THE FIXED-SATELLITE SERVICE**

(Question ITU-R 201/4)

(1997)

The ITU Radiocommunication Assembly,

considering

- a) that digital satellite systems will remain as constituents elements of public/private networks in a technologically independent way;
- b) that ITU-T Recommendation G.707 (1996) specifies the Synchronous Digital Hierarchy (SDH);
- c) that ITU-T Recommendations G.803 and G.805 define the architecture of SDH transport networks which should be reflected in to the management functionality definitions;
- d) that ITU-T Recommendation G.783 specifies the general characteristics and functions of synchronous multiplexing equipment which have to be measured and controlled via the management system;
- e) that ITU-T Recommendations G.831 and G.784 define the management principles and capabilities of SDH transport networks with which this Recommendation has to be compatible;
- f) that ITU-T Recommendation G.774 defines the managed objects for terrestrial SDH transport networks which form the precedents for the object definitions in this Recommendation;
- g) that compatibility with the Telecommunications Management Network (TMN) as defined in ITU-T Recommendation M.3000 is desirable;
- h) that ITU-T Recommendation G.861 defines the principles and guidelines for the integration of satellite and radio systems in SDH transport networks including their management capabilities;
- j) that Recommendation ITU-R S.1149 specifies aspects of satellite-based SDH transport networks,

recommends

that digital satellite systems in the fixed-satellite service (FSS) comply with the management functionality defined in this Recommendation to facilitate their integration with SDH transport networks.

1 Scope

The scope of this Recommendation is the definition of the performance management features of satellite specific SDH functions as defined in ITU-R Recommendation S.1149 – Network Architecture and Equipment functional aspects of Digital Satellite Systems in the FSS forming part of SDH transport networks.

One objective is to ensure that these features are compatible with terrestrial SDH transport network management systems.

This Recommendation is concerned with the lowest level details of the network management concept. This level is referred to as the “Network Element” level.

CONTENTS

	<i>Page</i>
1 Scope	1
1.1 Introduction to Performance Management (PM)	2
1.1.1 Background	2
1.1.2 Examples of performance parameters which may be captured by PM	2
2 PM requirements list	3
3 The performance management model	5
3.1 Description of object classes in the model	7
4 Inheritance hierarchy for PM object classes	7
5 Performance management object class definitions in GDMO format	9
5.1 ITU-T Recommendation Q.822 definitions	9
5.2 SDH technology specific object classes	10
5.2.1 ITU-T Recommendations G.774-01 and 06 definitions	10
5.2.2 Satellite specific PM object classes	12
5.3 Package definitions	22
5.4 Attributes	23
5.5 Supporting ASN.1 Productions	27
6 Naming hierarchy for PM object classes	27
6.1 Near end name bindings	27
6.1.1 Naming policy	28
6.2 Far end name bindings	30
6.2.1 Naming policy	30
6.3 Name bindings for additional satellite multiplex hierarchy performance monitoring points	35
7 Subordination rules	35
8 Pointer constraints	35

1.1 Introduction to Performance Management (PM)

1.1.1 Background

The definition of performance management for SDH transport systems is contained in ITU-T Recommendation G.774 Part 01 and Part 06. The satellite system object class definitions contained in this Recommendation are closely aligned with the latest **unidirectional** based version of G.774-06. ITU-T Recommendations G.774-01 and 06 are based upon ITU-T Recommendation Q.822 "Stage 1, 2 and 3 Description for the Q3 Interface, Performance Management".

1.1.2 Examples of performance parameters which may be captured by PM

The following list contains examples of parameters which may be captured via the PM functions defined in this Recommendation. The list is not exhaustive and is not intended to limit the choice of parameters which a network operator may implement.

- Errored seconds Separate parameters are recorded for the near end and the far end
- Severely errored seconds Separate parameters are recorded for the near end and the far end
- Unavailable seconds Separate parameters are recorded for the near end and the far end
- Controlled slips Separate parameters are recorded for the near end and the far end
- Threshold transgressions Separate parameters are recorded for the near end and the far end



The conditions, under which any parameters are recorded, are important and the control of these conditions is included in the definition of the PM functions.

2 PM requirements list

The PM requirements list from ITU-T Recommendation G.774-01 is summarized below:

- Supports PM event generation by Network Elements (NEs).
- Supports PM event collection from NEs by management systems.
- Supports manager control of start/suspend/resume/reset/stop of PM functions.
- Supports notification reports of PM collection from NEs to managers.
- Supports NE storage of results for delayed collection by managers.
- Supports historical data collection and storage by NEs.
- Supports editing of this historical data.
- Supports the changing of thresholds in NEs by managers.
- Supports the sending of Quality of Service (QoS) notifications from NEs when thresholds are crossed.

These requirements are satisfied in the terrestrial environment defined by ITU-T Recommendations G.774-01 and 06 by creating the SDH managed object classes listed in Table 1 which also shows the developments required to update the Recommendation from a bidirectional to a unidirectional basis.

TABLE 1

ITU-T Recommendation G.774 terrestrial environment managed object classes

Existing ITU-T Recommendation G.774-01	Revised ITU-T Recommendation G.774-06 (1996)	Comments
sdhCurrentData	sdhCurrentDataUnidirectional	Use for new work
msCurrentData	msCurrentDataNearEnd	Use for new work
	msCurrentDataFarEnd	Continue to use
msCurrentDataTR	msCurrentDataNearEndTR	Use for new work
	msCurrentDataFarEndTR	Continue to use
pathTerminationCurrentData	pathTerminationCurrentDataNearEnd	Use for new work
	pathTerminationCurrentDataFarEnd	Continue to use

TABLE 1 (continued)

Existing ITU-T Recommendation G.774-01	Revised ITU-T Recommendation G.774-06 (1996)	Comments
pathTerminationCurrentDataTR	pathTerminationCurrentDataNearEndTR	Use for new work
	pathTerminationCurrentDataFarEndTR	Continue to use
msHistoryData	msHistoryDataNearEnd	Use for new work
	msHistoryDataFarEnd	Continue to use
pathTerminationHistoryData	pathTerminationHistoryDataNearEnd	Use for new work
	pathTerminationHistoryDataFarEnd	Continue to use
rsSectionCurrentData		Use for near end PM only
rsSectionCurrentDataTR		Use for near end PM only
rsHistoryData		Use for near end PM only
msAdaptationCurrentData		No change
msAdaptationHistoryData		No change

OTE 1 – The letters TR refer to threshold reset.

OTE 2 – The object class sdhCurrentDataR1, which was defined in the first issue of ITU-T Recommendation G.774-06 has been replaced by a new class sdhCurrentDataUnidirectional, because it was considered to be an extension of the PM concept but not a revision.

The requirements list was considered to be sufficiently general to encompass the satellite environment apart from an additional requirement for different durations of recording intervals. It was considered to be necessary to create specific managed object classes to support the specialized satellite SDH equipment, and these object classes are listed in Table 2.

TABLE 2
Satellite specific managed object classes

Satellite object class	Equivalent terrestrial object class
satSDHCurrentDataUnidirectional	sdhCurrentDataUnidirectional
satMSCurrentDataNearEnd	msCurrentDataNearEnd
satMSCurrentDataNearEndTR	msCurrentDataNearEndTR

TABLE 2 (continued)

Satellite object class	Equivalent terrestrial object class
satPathTermCurrentDataNearEnd	pathTerminationCurrentDataNearEnd
satPathTermCurrentDataNearEndTR	pathTerminationCurrentDataNearEndTR
satMSCurrentDataFarEnd	msCurrentDataFarEnd
satMSCurrentDataFarEndTR	msCurrentDataFarEndTR
satPathTermCurrentDataFarEnd	pathTerminationCurrentDataFarEnd
satPathTermCurrentDataFarEndTR	pathTerminationCurrentDataTR
satMSHistoryDataNearEnd	msHistoryDataNearEnd
satPathTermHistoryDataNearEnd	pathTerminationHistoryDataNearEnd
satMSHistoryDataFarEnd	msHistoryDataFarEnd
satPathTermHistoryDataFarEnd	pathTerminationHistoryDataFarEnd
satMSAdaptCurrentData	msAdaptationCurrentData
satMSAdaptHistoryData	msAdaptationHistoryData

The full text of these satellite object class definitions, in GDMO format as defined in ITU-T Recommendation X.722, follows the tables. All satellite specific object classes start with the letters “sat” to distinguish them from terrestrial object classes.

Terrestrial SDH PM managed objects may be employed in SDH equipment located in satellite earth stations, particularly for the SDH functions near to the terrestrial interface.

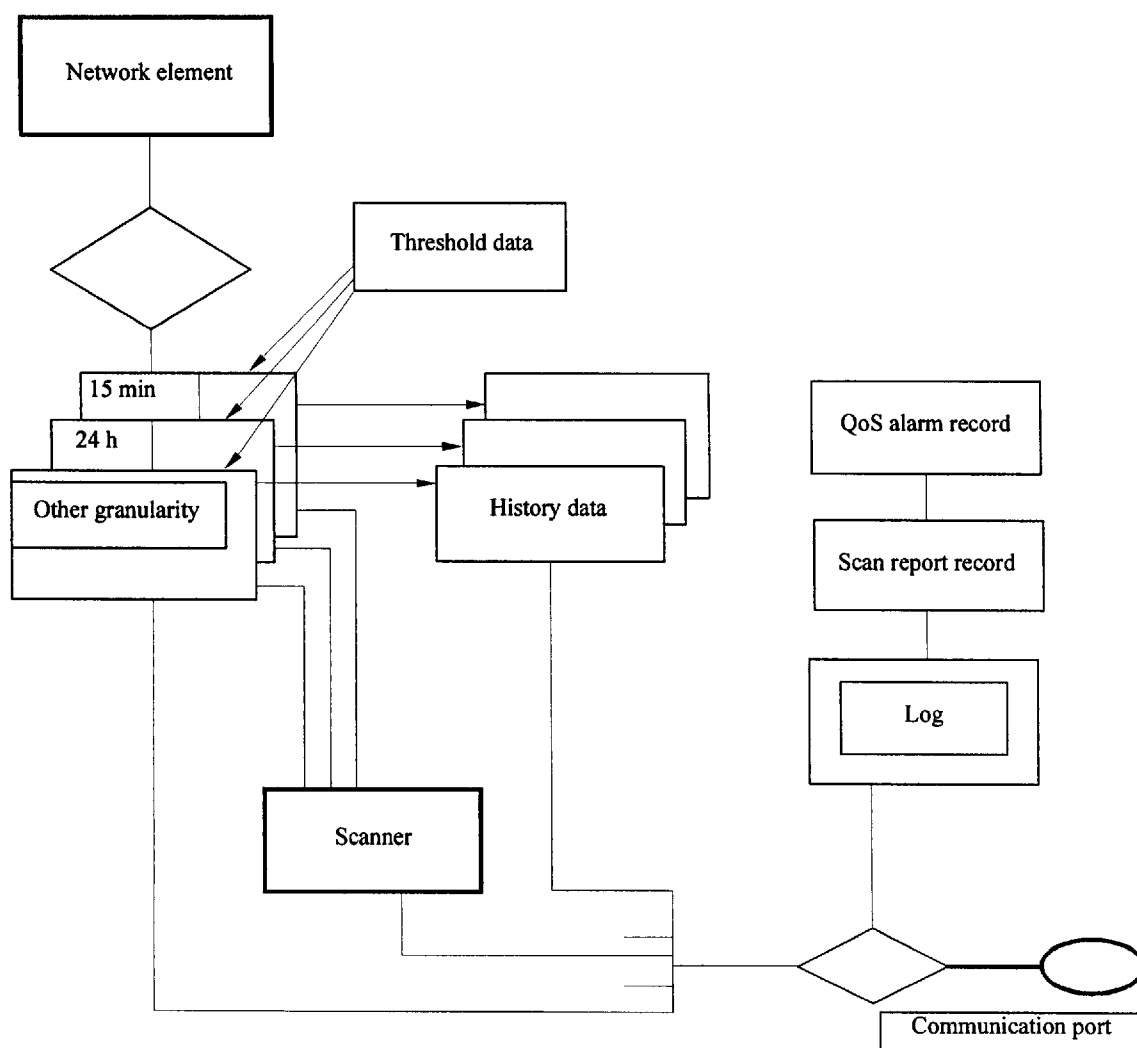
If the physical hardware is highly integrated, then managed objects from both environments might be deployed in the same piece of equipment.

3 The performance management model

The performance management services are modelled as illustrated in Fig. 1. This shows current PM data being collected from a monitored Network Element (NE) via a currentData object for a defined period called the granularity period. At the end of each measurement period a summary report (scanReport) may be issued and the result is also forwarded to the historyData object.

ITU-R S.1251-1997

FIGURE 1
The performance management information model



1251-01

Thresholds are controlled via thresholdData objects and when a threshold is transgressed a PM alarm may be generated by the currentData object issuing a notification message. All events may be logged for future reference in an eventRecord stored in the log function and any performance measurement may be statistically processed by the use of scanner objects.

The scanner reports may include several types of content: e.g. a time series of measurements from one NE, or a number of measurements across a number of objects, or general statistics for single or multiple objects across single or multiple time instances.

CSES events are only managed in the sdhCurrentData subclass instances that employ 15 min granularity periods. This is to avoid information duplication.

Bidirectional monitoring information which might be required for backward compatibility may be derived from the unidirectional measurements so it is considered that there is no need for extra objects to provide bidirectional monitoring.

3.1 Description of object classes in the model

The currentData object will be an instantiation of the object class of currentDataR1 and will perform the accumulation or other measurement of the parameter being monitored for the specified interval, called the granularity period. At the end of each interval the object will inform the corresponding historyData object of the result for storage. It may also emit a scanReport notification which may result in a corresponding event report being sent to a managing system (it is not mandatory that the discriminator construct in the log be configured such that this notification is logged).

The currentData object may contain a pointer to a thresholdData object if any of the thresholds are variable. When a threshold is transgressed a QoS alarm notification is sent to the managing system. This event may be logged.

The historyData object contains a copy of the results for each granularity period.

The thresholdData object contains a set of threshold values and is referenced from the currentData object by a pointer.

There are several types of scanners defined in ITU-T Recommendation X.738 and any of these may be used. The scanner function may be employed to aggregate sets of measurements from a number of currentData or historyData objects. The scanner may prepare a scanReport for bulk transfer of information to a managing system, or it may undertake some local processing to minimize the amount of data that needs to be transferred. e.g. derive mean values or calculate variances. The scanReport may also be stored in the log for future reference.

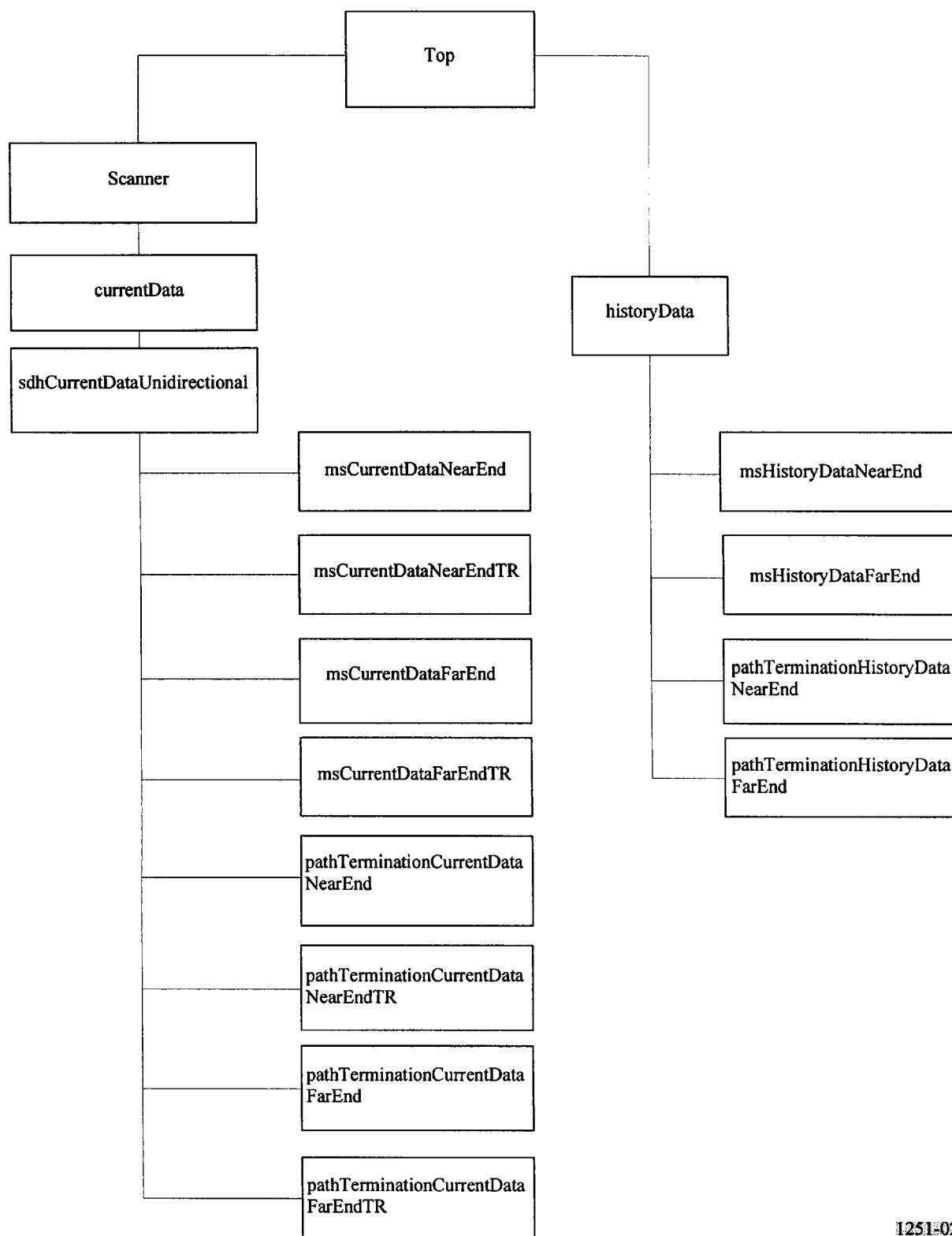
The type of scanners which may be employed, for example, are; the simpleScanner or the dynamicSimpleScanner. Scanners which can perform calculations are; the meanScanner, the meanVarianceScanner and the minMaxScanner.

For detailed analysis of a difficult problem it may be better to access the historyData object directly rather than the derived statistics in the scanReport. Also the scanReport in the generic log may have been overwritten if a significant amount of time has passed or the log has had to accept a large number of entries.

4 Inheritance hierarchy for PM object classes

The PM inheritance hierarchy for SDH transport systems is specialized for SDH technology as distinct from the general PM hierarchy as defined in ITU-T Recommendation Q.822.

FIGURE 2
The inheritance hierarchy for SDH PM



1251-02

5 Performance management object class definitions in GDMO format

ITU-T Recommendation Q.822 (1994) contains the definitions of the basic object classes involved in PM i.e. currentData, thresholdData and historyData. These object definitions are reproduced here to assist with the comprehension of PM but the reference source remains ITU-T Recommendation Q.822.

5.1 ITU-T Recommendation Q.822 definitions

currentData **MANAGED OBJECT CLASS**

DERIVED FROM "ITU-T Recommendation X.739:1993":scanner;

CHARACTERIZED BY currentDataPkg **PACKAGE**

BEHAVIOUR currentDataBehaviour **BEHAVIOUR**

DEFINED AS

"The currentData object class is a class of managed support objects that contain the current performance data. This object class is a particular type of scanner that scans its own attributes (see ITU-T Recommendation X.739).

Performance parameters are modelled as attributes. These attributes appear either explicitly in the definition of sub-classes of currentData or they are contained in the measurementListPkg if the instantiated object class is currentData.

Typically, performance attributes are derived from counter or gauge attributes and both of these attributes are defined in ITU-T Recommendation X.721. All attributes with a 'Count' type syntax (e.g. errored seconds) shall be cleared (reset) locally at the end of the granularity period. To provide continuous counts, the granularityPeriod can be set to an arbitrarily large value using CHOICE.

If the administrativeState is locked or the operationalState is disabled or the currentData object is scheduled off-duty, then the values of the counters are undefined and historyData objects, if employed, are not created at the end of the granularity period.";;

ATTRIBUTES

suspectIntervalFlag **REPLACE-WITH-DEFAULT** **GET**,

DEFAULT VALUE Q822-PM-ASN1Module.defaultCurrentDataSuspectIntervalFlag **GET**,

elapsedTime **GET**;;

CONDITIONAL PACKAGES

filterSuppressionPkg **PRESENT IF** "an instance supports it and the zeroSuppressionPkg is not present.",

historyRetentionPkg **PRESENT IF** "historyData objects are to be created at the end of an interval.",

maxSuppressionIntervalsPkg **PRESENT IF** "an instance supports it and at least one of zeroSuppressionPkg or filterSuppressionPkg is present.",

measurementListPkg **PRESENT IF** "an instance supports it or the object class is currentData.",

numSuppressedIntervalsPkg **PRESENT IF** "suppression counts are required and the filterSuppressionPkg or the zeroSuppressionPkg is present.",

observedManagedObjectPkg **PRESENT IF** "an instance supports it.",

scheduledPMReportPkg **PRESENT IF** "scheduled notifications are to be emitted.",

thresholdPkg **PRESENT IF** "a quality of service alarm notification is to be emitted at threshold crossing.",

zeroSuppressionPkg **PRESENT IF** "an instance supports it and the filterSuppressionPkg is not present.";

REGISTERED AS {q822ObjectClass 1};

historyData **MANAGED OBJECT CLASS**

DERIVED FROM "ITU-T Recommendation X.721:1992":top;

CHARACTERIZED BY historyDataPkg **PACKAGE**

BEHAVIOUR historyDataBehaviour **BEHAVIOUR**

DEFINED AS

"Attribute values stored in a historyData object are an exact copy of the values in the corresponding currentData object at the end of the measurement period.

The time at the end of the measurement period is indicated by the value of the attribute periodEndTime.";;

ATTRIBUTES

historyDataId **GET,**
 periodEndTime **GET,**
 granularityPeriod "Recommendation X.739:1993" **GET;;;**

CONDITIONAL PACKAGES

historyDataMeasurementListPkg **PRESENT IF** "the measurementListPkg is present in the corresponding currentData instance.",
 historyDataSuspectIntervalFlagPkg **PRESENT IF** "an instance supports it.",
 numSuppressedIntervalsPkg **PRESENT IF** "this package is present in the corresponding currentData instance.",
 objectDeleteNotificationPkg **PRESENT IF** "an instance supports it.",
 observedManagedObjectPkg **PRESENT IF** "this package is present in the corresponding currentData instance.";

REGISTERED AS {q822ObjectClass 2};

thresholdData **MANAGED OBJECT CLASS**

DERIVED FROM "ITU-T Recommendation X.721:1992":top;

CHARACTERIZED BY thresholdDataPkg **PACKAGE**

BEHAVIOUR thresholdDataBehaviour **BEHAVIOUR**

DEFINED AS

"The thresholdData object class is a class of support objects that contains the values of the threshold settings for the PM parameters. At least one of the counterThresholdListPkg or the gaugeThresholdListPkg must be instantiated.";

ATTRIBUTES

thresholdDataId **GET;;;**

CONDITIONAL PACKAGES

counterThresholdListPkg **PRESENT IF** "an instance supports it and the gaugeThresholdListPkg is not present.",
 gaugeThresholdListPkg **PRESENT IF** "an instance supports it and the counterThresholdListPkg is not present.",
 thresholdVerificationPkg **PRESENT IF** "an instance supports it.",
 attributeValueChangeNotificationPkg
 "Recommendation M.3100:1992" **PRESENT IF** "an instance supports it.",
 createDeleteNotificationPkg
 "Recommendation M.3100:1992" **PRESENT IF** "an instance supports it.";

REGISTERED AS {q822ObjectClass 3};

5.2 SDH technology specific object classes

The following object class definitions have been taken from ITU-T Recommendations G.774-01 and 06 (1996) unidirection version and are included here to assist the comprehension of PM as applied to satellite systems.

5.2.1 ITU-T Recommendations G.774-01 and 06 definitions

sdhCurrentDataUnidirectional **MANAGED OBJECT CLASS**

DERIVED FROM "ITU-T Recommendation Q.822 1994":currentData;

CHARACTERIZED BY

"ITU-T Recommendation Q.822 1994":zeroSuppressionPackage,

"ITU-T Recommendation Q.822 1994":thresholdPackage,

sdhCurrentDataUnidirectionalPackage **PACKAGE**

BEHAVIOUR sdhCurrentDataUnidirectionalBehaviour **BEHAVIOUR**

DEFINED AS

"The `sdhCurrentDataUnidirectional` class defines generic characteristics for unidirectional SDH performance monitoring. Sub-classes are derived from this class to hold performance event counts for specified monitoring points and to support PM of SDH trails at the various layers described in ITU-T Recommendation G.805.

Events are defined in ITU-T Recommendation G.826 namely:

- Errored Seconds (ES),
- Severely Errored Seconds (SES),
- Background Block Errors (BBE).

These events are monitored in two mandatory time intervals, 15 min and 24 h, which are referred to as granularity periods. The `granularityPeriod` attribute can only be assigned a value when the object is created.

This class can contain only one reference to a `thresholdData` object in the `thresholdDataInstance` attribute. If a threshold is reached or crossed then the `currentProblemList` attribute shall indicate it with the probable cause "Threshold Crossed".

Sub-classes of this class are used to monitor the near-end or far-end performance data of a trail.

A period of unavailable time begins at the onset of 10 consecutive SES events. These 10 s are considered to be part of the unavailable time. A period of available time begins at the onset of 10 consecutive non-SES events. These 10 s are considered to be part of available time.

The unavailability conditions are kept separate for near-end and far-end monitoring. This means that 10 consecutive SES at the near-end affect only the near-end unavailability and *vice versa*.

For threshold reset sub-classes of this class the following rules apply:

No more than one QoS alarm shall be generated until there has been a 15 min continuous window with no unavailable time and an error count below the low error count threshold.

The `counterThresholdAttributeList` attribute of a Q.822 `thresholdDataInstance` is used to provide the high and low threshold values.

If the `unavailableTimeAlarmPackage` is in use then an alarm is generated with a probable cause of Unavailable when this condition is detected and the condition shall be indicated in the `currentProblemList` attribute. When the unavailable condition ends, a communication alarm is emitted with a probable cause of Unavailable and a severity marking of "Cleared".

An available condition is indicated by the absence of the Unavailable condition in the `currentProblemList`. The unavailable condition has no effect upon the `operationalState` but performance event counts are inhibited for the direction of transmission which is marked as unavailable.

The following conditional packages are not used in this class; `filterSuppressionPkg` and `observedManagedObjectPkg`.

The following rule applies to sub-classes of this object class:

If a sub-class has a granularity period of 15 min, it should be either an instance with the threshold reset functionality or an instance without this functionality instantiated (per termination point) but not both.";;

ATTRIBUTES

`currentProblemList` "ITU-T Recommendation M.3100:1992" **GET**;;;

CONDITIONAL PACKAGES

`unavailableTimeAlarmPackage`

"Recommendation G.774-01:1993"

PRESENT IF "It is required that a report is generated at the starting and ending of an unavailable period and the granularity period is 24 h.",

`historyPackage` "Recommendation G.774-01:1993"

PRESENT IF "an instance does not support flexible assignment of the history length.";

REGISTERED AS {g774-06MObjectClass 1};

`msCurrentDataNearEnd` **MANAGED OBJECT CLASS**

DERIVED FROM `sdhCurrentDataUnidirectional`;

CHARACTERIZED BY

`msCurrentDataNearEndPackage` **PACKAGE**

BEHAVIOUR `msCurrentDataNearEndBehaviour` **BEHAVIOUR**

DEFINED AS

"Instances of this object class are used to hold the current near end register counts for a multiplex section trail termination point during a collection period.

The following performance primitives are observed:

- Errored Block (EB).

The performance event is the BBE, the Background Block Error.

For the EB and the MS-AIS and Excessive Error defects the following performance events are defined:

- Errored Seconds (ES),
- Severely Errored Seconds (SES),
- Unavailable seconds (UAS), this counter records near-end unavailability only.

In addition, the following optional performance events are defined:

- Failure Counts (FC) (near-end),
- Errored Seconds A (ESA) (near-end),
- Errored Seconds B (ESB) (near-end).

Only one threshold value per performance counter will be supported.

A QoS alarm shall be sent as soon as a threshold is reached or crossed. At the end of the granularity period the QoS alarm is implicitly cleared, providing that there are no other outstanding QoS alarms, and threshold crossing is removed from the the currentProblemList (i.e. no notification is emitted). If the threshold is reached or crossed again during the next granularity period a new QoS alarm shall be sent.

This object class uses the msHistoryDataNearEnd object class for storage.";;

ATTRIBUTES

granularityPeriod "ITU-T Recommendation X.739:1993"

REQUIRED VALUES

SDHPMUNIASN1.SDHGranularityPeriod,

bBE "Recommendation G.774-01:1993"

REPLACE-WITH-DEFAULT GET,

eS "Recommendation G.774-01:1993"

REPLACE-WITH-DEFAULT GET,

sES "Recommendation G.774-01:1993"

REPLACE-WITH-DEFAULT GET;;;

CONDITIONAL PACKAGES

nearEndUASCurrentDataPackage

PRESENT IF "If an instance supports it.",

cSESCurrentDataPackage

"Recommendation G.774-01:1993"

PRESENT IF "an instance supports it and the granularity period is 15 min.",

failureCountsNearEndPackage

PRESENT IF "an instance supports it.",

eSANearEndPackage

PRESENT IF "an instance supports it.",

eSBNearEndPackage

PRESENT IF "an instance supports it.";

REGISTERED AS {g774-06MObjectClass 2};

5.2.2 Satellite specific PM object classes**5.2.2.1 Satellite SDH current data unidirectional**

satSDHCurrentDataUnidirectional **MANAGED OBJECT CLASS**

DERIVED FROM "ITU-T Recommendation Q.822 1994":currentData;

CHARACTERIZED BY

"ITU-T Recommendation Q.822 1994":zeroSuppressionPackage,

"ITU-T Recommendation Q.822 1994":thresholdPackage,

satSDHCurrentDataUnidirectionalPackage **PACKAGE**

BEHAVIOUR satSDHCurrentDataUnidirectionalBehaviour **BEHAVIOUR**

DEFINED AS

"This object class defines generic characteristics for unidirectional performance monitoring of SDH satellite systems.

Sub-classes of this class are used to monitor near-end or far-end performance individually.



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