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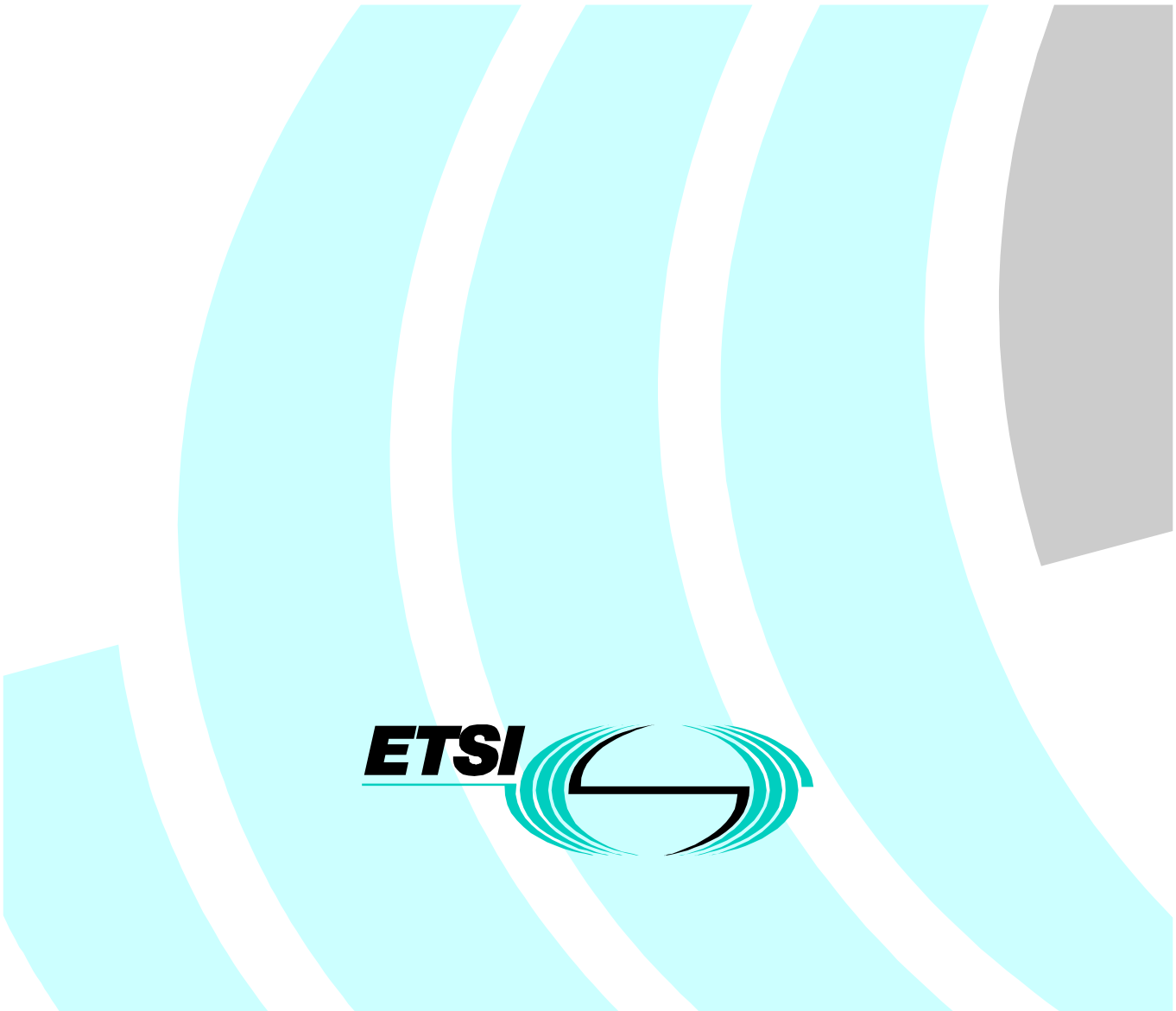
European Standard (Telecommunications series)

**Telecommunications Management Network (TMN);
Q3 interface at the Local Exchange (LE)
for fault and performance management
of V5 interfaces and associated customer profiles;
Part 1: Q3 interface specification**



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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Telecommunications Management Network (TMN).

The present document is part 1 of a multi-part EN covering the Q3 interface at the Local Exchange (LE) for fault and performance management of V5 interfaces and associated customer profiles, as identified below:

Part 1: "Q3 interface specification";

Part 2: "Managed Objects Conformance Statement (MOCS) proforma" (for further study).

National transposition dates	
Date of adoption of this EN:	15 October 1999
Date of latest announcement of this EN (doa):	31 January 2000
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 July 2000
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Introduction

V5 interfaces, as described in EN 300 324-1 [2] and EN 300 347-1 [3], operate between a Local Exchange (LE) and an Access Network (AN) to support various narrowband Integrated Services Digital Network (ISDN) and Public Switched Telephone Network (PSTN) services. These interfaces and their associated user ports need to be managed by the Operations Systems (OSs) within the Telecommunications Management Network (TMN). This management is performed by means of Q3 interfaces.

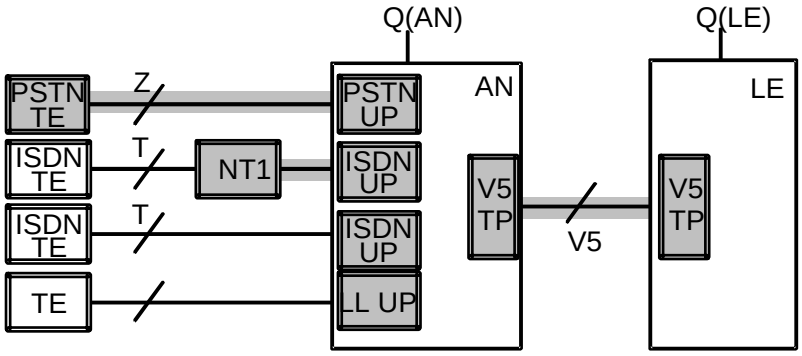
The companion standard on configuration management EN 300 377-1 [4] defines how the Q3 interface of a LE handles the configuration information for V5 interfaces and their associated customer profiles. The present document describes the extension to include fault and performance management.

Fault management of V5 interfaces and associated user ports is part of a management activity which is performed by the operator in order to detect failure conditions and to bring the customer access back to its normal state of operation whenever a deviation occurs.

Performance management of V5 interfaces and associated user ports is part of a management activity which is employed in order to maintain the quality of service levels agreed with the customers. The activities undertaken in performance management are monitoring, analysis and problem alerting, diagnosis, optimization and control.

A customer access is considered as being that part of the local network which extends from the network termination equipment up to and including the exchange termination.

Here, only these parts of the activities are covered which are related directly to a V5 interface between a LE and an AN or to that part of the customer access which extends from the AN to the network termination equipment. An ISDN access extends to but does not include the T reference point. An analogue access extends to and may include the Customer Premise Equipment (CPE) (see figure 1).



NOTE: Shaded areas are subject to V5 fault and performance management. User ports represent the different configurations for Line Circuit (LC), Line Termination (LT), Exchange Termination (ET) and Network Termination (NT) as indicated in EN 300 324-1 [2] and EN 300 347-1 [3].

Figure 1: Scope of V5 fault and performance management

The present document details only those functions and management information model components for which V5 specific descriptions are required. However, the use of other components which may be applicable from other specifications is not precluded. In this case, combined application incorporating both V5-specific and more generic aspects would result. For example, if log control is to be provided in conjunction with the V5 specific alarm reporting function (see annex A) then other specifications (e.g. ITU-T Recommendation X.735 [17]) are available to define this.

The management information model described in the present document complements that for configuration; both information models will normally share the same physical interface.

1 Scope

The present document specifies the Q3 interface between a Local Exchange (LE) and the Telecommunications Management Network (TMN) for the support of Fault and Performance Management functions for V5 interfaces, as described in EN 300 324-1 [2] and EN 300 347-1 [3], and their associated customer profiles. The management of transmission, media and services which are not related to V5 interfaces is outside the scope of the present document, as is the management of equipment. The present document includes the logging of faults and related functions.

For certain implementations, some test related functions like line monitoring, pattern injection for loop back tests and Dual Tone Multi-Frequency (DTMF) measurements may also be performed in the LE, e.g. due to economical reasons. A Q interface for these functions is required at the LE. As they are not V5 specific, this has to be handled within an overall LE test model which is outside the scope of the present document.

The location of the Q3 interface to which the present document refers is specified in EN 300 377-1 [4].

Existing protocols are used where possible, and the focus of the work is on defining the object models. The definition of Operations System (OS) functionality is outside the scope of the present document.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] Void.

[2] EN 300 324-1: "V interfaces at the digital Local Exchange (LE); V5.1 interface for the support of Access Network (AN); Part 1: V5.1 interface specification".

[3] EN 300 347-1: "V interfaces at the digital Local Exchange (LE); V5.2 interface for the support of Access Network (AN); Part 1: V5.2 interface specification".

[4] EN 300 377-1: "Q3 interface at the Local Exchange (LE) for configuration management of V5 interfaces and associated customer profiles; Part 1: Q3 interface specification".

[5] CEPT Recommendation T/S 54-08 E (1987): "ISDN subscriber access and installation maintenance".

[6] ITU-T Recommendation M.3010 (1996): "Principles for a telecommunications management network".

[7] ITU-T Recommendation M.3100 (1995): "Generic network information model".

[8] ITU-T Recommendation Q.821 (1993): "Stage 2 and stage 3 description for the Q3 interface; Alarm surveillance".

[9] ITU-T Recommendation Q.822 (1994): "Stage 1, stage 2 and stage 3 description for the Q3 interface; Performance management".

[10] CCITT Recommendation X.208 (1988): "Specification of Abstract Syntax Notification One (ASN.1)".

[11] ITU-T Recommendation X.721 | ISO/IEC 10165-2 (1992): "Information technology; Open systems interconnection; Structure of management information: Definition of management information".

[12] Void.

[13] Void.

[14] Void.

[15] ITU-T Recommendation X.733 | ISO/IEC 10164-4 (1992): "Information technology; Open systems interconnection; Systems management: Alarm reporting function".

[16] ITU-T Recommendation X.734 | ISO/IEC 10164-5 (1992): "Information technology; Open systems interconnection; Systems management: Event report management function".

[17] ITU-T Recommendation X.735 | ISO/IEC 10164-6 (1992): "Information technology; Open systems interconnection; Systems management: Log control functions".

[18] ITU-T Recommendation X.738 | ISO/IEC 10164-13 (1993): "Information technology; Open systems interconnection; Systems management: Summarization function".

[19] ITU-T Recommendation X.739 | ISO/IEC 10164-11 (1993): "Information technology; Open systems interconnection; Systems management: Metric objects and attributes".

[20] Void.

[21] ITU-T Recommendation Q.831 (1997): "Fault and performance management of V5 interface environments and associated customer profiles".

[22] ITU-T Recommendation Q.835 (1999): "Line and line circuit test management of ISDN and analogue customer accesses".

[23] EN 300 378-1: "Telecommunication Management Network (TMN); Q3 interface at the Access Network (AN) for fault and performance management of V5 interfaces and associated user ports; Part 1: Q3 interface specification".

[24] ITU-T Recommendation Q.824.5 (1997): "Stage 2 and stage 3 description for the Q3 interface; Customer administration: Configuration management of V5 interface environments and associated customer profiles".

[25] EN 300 291-1: "Telecommunications Management Network (TMN); Functional specification of Customer Administration (CA) on the Operations System/Network Element (OS/NE) interface; Part 1: Single line configurations".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

Access Network (AN): see EN 300 324-1 [2]

bearer channel: see EN 300 324-1 [2]

Bearer Channel Connection (BCC): see EN 300 347-1 [3]

Communication channel (C-channel): see EN 300 324-1 [2]

Communication path (C-path): see EN 300 324-1 [2]

control protocol: see EN 300 324-1 [2]

envelope function address: see EN 300 324-1 [2]

layer 3 address: see EN 300 324-1 [2]

leased lines: see EN 300 324-1 [2]

Local Exchange (LE): See EN 300 324-1 [2]

Operations System (OS): see ITU-T Recommendation M.3010 [6]

protection protocol: see EN 300 347-1 [3]

V5 interface: see EN 300 324-1 [2]

V5 interface messages: this term refers to all Function Elements (FEs) and other V5 protocol messages as defined in EN 300 324-1 [2] and EN 300 347-1 [3] which are communicated via the V5 interface

V5 time slot: see EN 300 324-1 [2]

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AIS	Alarm Indication Signal
AN	Access Network
ASN.1	Abstract Syntax Notation One (see CCITT Recommendation X.208 [10])
BCC	Bearer Channel Connection
C-channel	Communication channel
C-path	Communication path
CPE	Customer Premise Equipment
CRC	Cyclic Redundancy Check
DTMF	Dual Tone Multi-Frequency
ET	Exchange Termination
ID	Identity, identifier
ISDN	Integrated Services Digital Network
LAPV5	Link Access Protocol for V5 interface
LC	Line Circuit
LE	Local Exchange
LFA	Loss of Frame Alignment
LT	Line Termination
M/C/O	Mandatory/Conditional/Optional
NE	Network Element
NT	Network Termination
OS	Operations System
PM	Performance Management
PSTN	Public Switched Telephone Network
RAI	Remote Alarm Indication
RDN	Relative Distinguished Name
TIB	Task Information Base
TMN	Telecommunications Management Network
TTP	Trail Termination Point

4 Information model diagrams

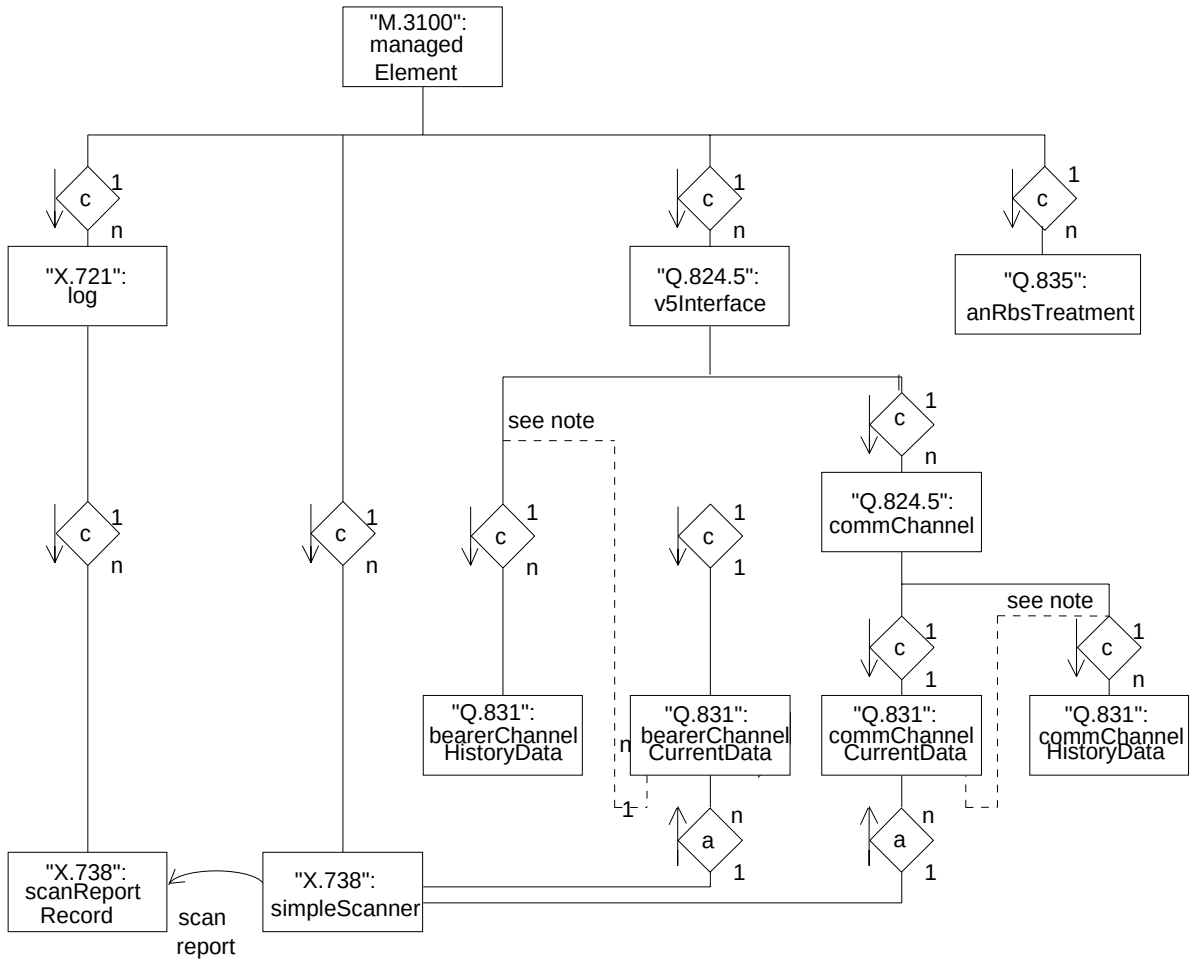
The entity relationship diagram is given in subclause 4.1 and the inheritance hierarchy (is-a relationships) and naming hierarchy (containment relationships) are given in subclauses 4.2 and 4.3, respectively.

4.1 Entity relationship diagram

Traffic measurements in the LE are concerned with bearer channel allocation and communication channel traffic characteristics. Subclasses of ITU-T Recommendation Q.822 [9] currentData object class are used to store traffic measurement data obtained from the object instance they are contained in. The current data is updated every 15 minutes.

The object class bearer channel current data has attributes for bearer channel oriented performance measurements of a V5.2 interface. The measurement results are obtained from the V5 Interface object instance representing the V5.2 interface. The object class comm channel current data is contained in an instance of comm channel. It has attributes for communication channel oriented measurements related to a V5 communication channel.

An instance of ITU-T Recommendation X.738 [18] simple scanner object class may be used to collect the traffic measurement results stored in comm channel current data and bearer channel current data object instances in a certain time interval. It generates a scan report notification being sent to the managing system. In addition, results may be logged in a scan report record object instance which is contained in a log object.



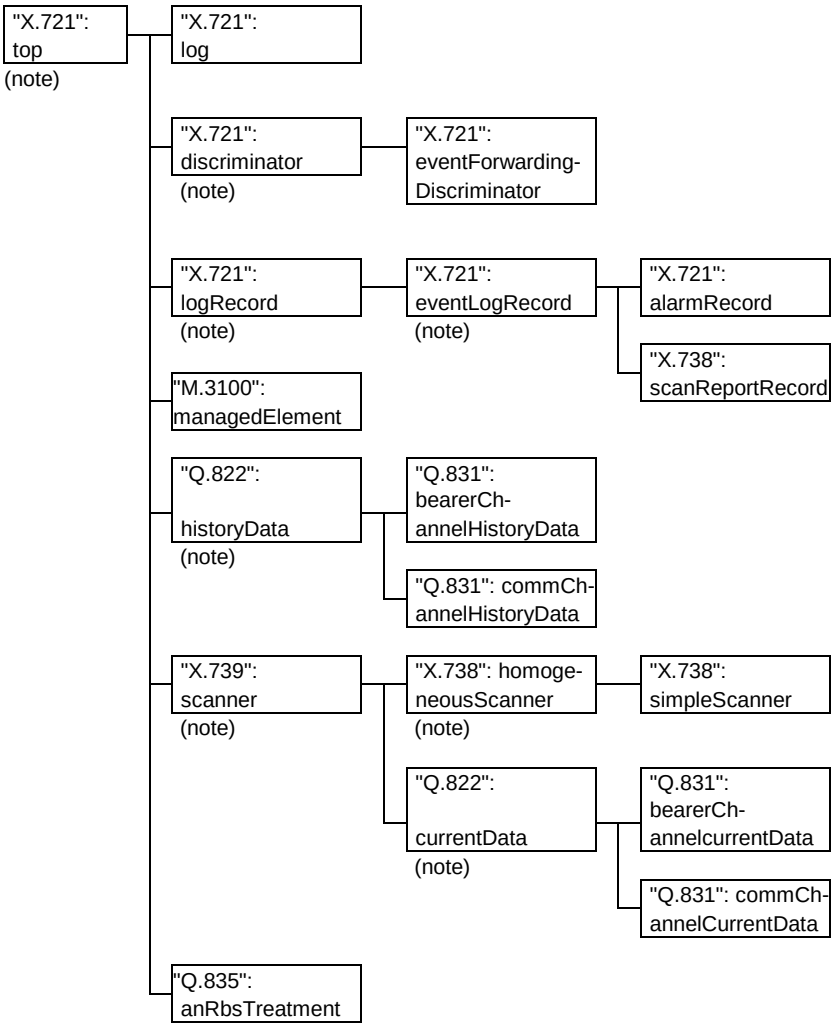
NOTE: History data objects may also be contained in the related current data objects.

Figure 2: Entity relationship diagram - V5 traffic measurement

Instead of generating scan reports, instances of the object classes bearer channel history data and comm channel history data may be used to store the traffic measurement results. New instances of these object classes are created at the end of each interval.

4.2 Inheritance hierarchy

Figure 3 traces the inheritance from the highest level object "ITU-T Recommendation X.721 [11]": top to the managed objects defined in the present document.

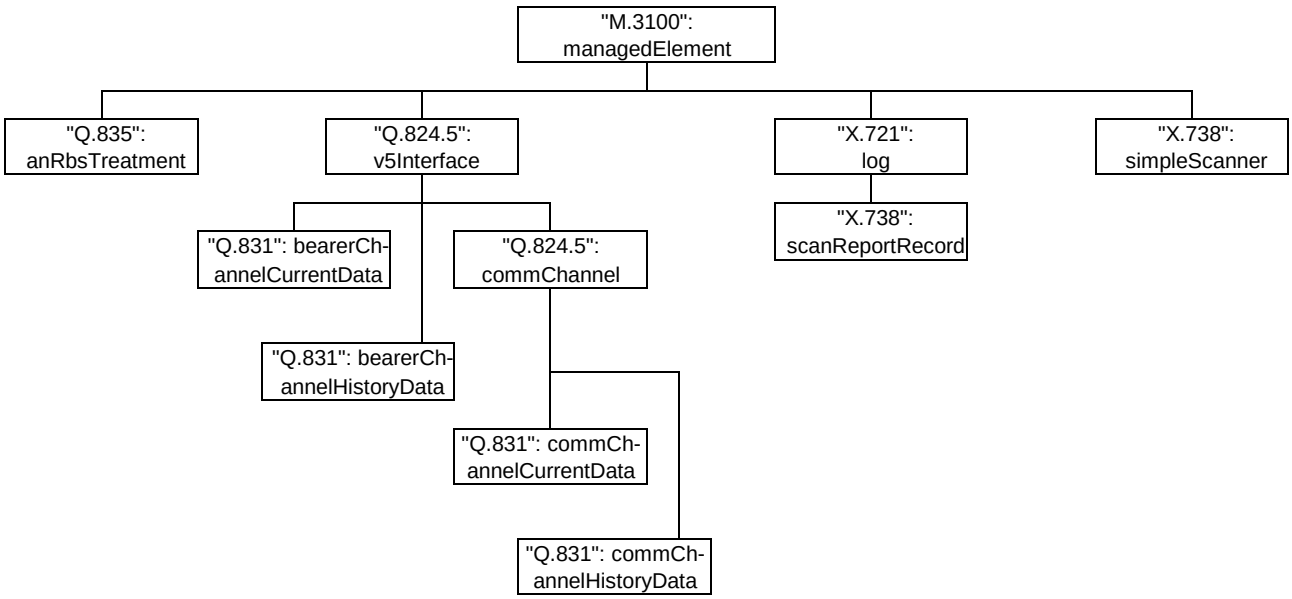


NOTE: Non-instantiable object class.

Figure 3: Inheritance hierarchy

4.3 Naming hierarchy

Figure 4 shows the naming (i.e. containment) relationships for the LE's managed objects associated with fault and performance management.



NOTE: History data objects may also be named from the related current data objects.

Figure 4: Naming hierarchy

5 Information model description

This clause provides a high-level informal description of the information model for fault and performance management of the LE.

Subclause 5.1 contains a brief description for each new object class or package used in the model as far as it is not described in the reference documents. The description covers:

- the purpose of the new object class or package;
- the attributes defined or inherited for the object class or package;
- the contents of the event reports defined in the present document;
- the relationship of the object class to other object classes;
- the applicability of the packages.

Attributes which are common to several object classes are described in subclause 5.2.

Subclause 5.3 describes actions which are influencing several object classes in the information model.

Subclause 5.4 describes the common aspects of the notifications used in the information model.

5.1 Managed object classes description

Subclause 5.1 is divided into subclauses which describe the fragments of the information model.

5.1.1 V5 interface fragment

In this fragment, the following object classes are used. They are defined in ITU-T Recommendation Q.824.5 [24]:

- V5 interface (v5Interface);
- V5 TTP (v5Ttp);
- V5 time slot (v5TimeSlot).

5.1.1.1 V5 interface (v5Interface)

V5 interface is an object class representing a V5.x interface (x = 1, 2, ...) as an abstract entity of its own right.

This managed object class is defined in ITU-T Recommendation Q.824.5 [24].

For V5 fault management the following packages shall be instantiated with instances of this object class:

- "ITU-T Recommendation M.3100 [7]": operationalStatePackage;
- "ITU-T Recommendation M.3100 [7]": tmnCommunicationsAlarmInformationPackage.

The following events shall be reported by instances of this object class using the communicationsAlarm notification (for the specification of the alarm reports and for cross reference to the relevant V5 protocol specifications, see annex A):

a) common control protocol time out errors;

b) port control protocol layer 3 address errors;

c) link control protocol layer 3 address errors;

d) BCC protocol time out errors;

e) protection protocol time out errors;

f) PSTN protocol time out errors;

g) PSTN protocol layer 3 address;

h) V5 Interface identification failures;

i) link control protocol data link failures;

j) BCC protocol data link failures;

k) protection protocol data link failures;

l) common control protocol data link failures;

m) PSTN protocol data link failures;

n) V5 interface provisioning variant mismatch failure.

The following events may be reported optionally:

a) common control protocol syntax errors;

b) control protocol layer 3 address errors;

c) BCC protocol syntax errors;

d) protection protocol syntax errors.

5.1.1.2 V5 trail termination point (v5Ttp)

A V5 trail termination point is an object class representing a 2 Mbit/s interface of the LE that is used as V5.1 interface or as part of a V5.2 interface.

This managed object class is defined in ITU-T Recommendation Q.824.5 [24].

For V5 fault management the following packages shall be instantiated with instances of this object class:

- "ITU-T Recommendation M.3100 [7]": tmnCommunicationsAlarmInformationPackage.

The following events have to be reported by instances of this object class using the communicationsAlarm notification (for the specification of the alarm reports and for cross reference to the relevant V5 protocol specifications, see annex A):

a) V5 interface layer 1 reception of Alarm Indication Signal (AIS);

b) V5 interface layer 1 reception of Remote Alarm Indication (RAI);

c) V5 interface layer 1 Loss of Frame Alignment (LFA);

d) link identification failures;

e) link control protocol time out errors;

f) link control protocol errors while "Out of Service";

g) link control protocol layer 3 address errors;

h) CRC errors;

i) internal failures.

The following events may be reported optionally:

- link control protocol syntax errors.

5.1.1.3 V5 time slot (v5TimeSlot)

A V5 time slot is an object class representing a 64 kbit/s channel of a V5 interface that is either used as bearer channel or as communication channel.

This managed object class is defined in ITU-T Recommendation Q.824.5 [24].

For V5 fault management the following packages shall be instantiated with instances of this object class if the time slot is used as a communication channel:

- "ITU-T Recommendation M.3100 [7]": tmn communications alarm information package.

The following events have to be reported by instances of this object class using the communicationsAlarm notification (for the specification of the alarm reports and for cross reference to the relevant V5 protocol specifications see annex A):

- cessation of flags on a C-channel.

5.1.2 Access port fragment

In this fragment the following object classes are used. They are defined in EN 300 291-1 [25]:

a) Virtual analogue access (virtualAnalogueAccessR1);

b) Virtual basic rate access (virtualBasicRateAccessR1);

c) Virtual primary rate access (virtualPrimaryRateAccessR1);

d) Virtual leased access (virtualLeasedAccessR1).

5.1.2.1 Virtual analogue access (virtualAnalogueAccessR1)

A virtual analogue access is an object class representing an image of an analogue (PSTN) customer access port which is located in an AN and connected to the LE via V5 interface.

This managed object class is defined in EN 300 291-1 [25].

For V5 fault management the following packages shall be instantiated with instances of this object class:

- "ITU-T Recommendation M.3100 [7]": tmnCommunicationsAlarmInformationPackage.

The following events shall be reported by instances of this object class using the communicationsAlarm notification (for the specification of the alarm reports and for cross reference to the relevant V5 protocol specifications, see annex A):

a) port control protocol time out errors;

b) port control protocol errors while "Out Of Service";

c) port control protocol layer 3 address error;

d) PSTN protocol time out errors;

e) PSTN protocol layer 3 address error.

The following events may be reported optionally:

a) port control protocol syntax errors;

b) PSTN protocol syntax errors.

In addition, the following package may be instantiated with instances of this object class if the associated interface is a V5.2 interface and the instance supports it:

- "ITU-T Recommendation Q.824.5 [24]": an fault reported package.

5.1.2.2 Virtual basic rate access (virtualBasicRateAccessR1)

A virtual basic rate access is an object class representing an image of an ISDN basic customer access port which is located in an AN and connected to the LE via V5 interface.

This managed object class is defined in EN 300 291-1 [25].

For V5 fault management the following packages shall be instantiated with instances of this object class:

- "ITU-T Recommendation M.3100 [7]": tmnCommunicationsAlarmInformationPackage.

The following events shall be reported by instances of the object class virtual basic rate access using the communicationsAlarm notification (for the specification of the alarm reports and for cross reference to the relevant V5 protocol specifications, see annex A):

a) ISDN layer 1 activation faults (only for an access with permanent layer 1 requested in the d channel activation attribute);

b) ISDN layer 2 faults (only for an access with permanent layer 2 requested in the dChannelActivation attribute);

c) ISDN layer 3 faults;

d) port control protocol time out errors;

e) port control protocol errors while "Out of Service";

f) port control protocol layer 3 address error.

The following events may be reported optionally:

- port control protocol syntax errors.

In addition, the following package may be instantiated with instances of this object class if the associated interface is a V5.2 interface and the instance supports it:

- "ITU-T Recommendation Q.824.5 [24]": an fault reported package.

For V5 performance management, the following packages shall be instantiated with instances of the object class virtual basic rate access whenever a degraded quality of service of the access digital section has to be reported to the OS:

- "ITU-T Recommendation Q.824.5 [24]": grading alarm package.

5.1.2.3 Virtual primary rate access (virtualPrimaryRateAccessR1)

A virtual primary rate access is an object class representing an image of an ISDN primary rate customer access port which is located in an AN and connected to the LE via V5 interface.

This managed object class is defined in EN 300 291-1 [25].

For V5 fault management the following packages shall be instantiated with instances of this object class:

- "ITU-T Recommendation M.3100 [7]": tmnCommunicationsAlarmInformationPackage.

The following events shall be reported by instances of the object class virtual primary rate access using the communicationsAlarm notification (for the specification of the alarm reports and for cross reference to the relevant V5 protocol specifications see annex A):

a) ISDN layer 1 activation faults;

b) ISDN layer 2 faults;

c) ISDN layer 3 faults;

d) port control protocol time out errors;

e) port control protocol errors while "Out of Service";

f) port control protocol layer 3 address error.

The following events may be reported optionally:

- port control protocol syntax errors.

In addition, the following package may be instantiated with instances of this object class if the associated interface is a V5.2 interface and the instance supports it:

- "ITU-T Recommendation Q.824.5 [24]": anFaultReportedPackage.

For V5 performance management the following packages shall be instantiated with instances of the object class virtual primary rate access whenever a degraded quality of service of the access digital section has to be reported to the OS:

- "ITU-T Recommendation Q.824.5 [24]": gradingAlarmPackage.

5.1.2.4 Virtual leased access (virtualLeasedAccessR1)

A virtual leased access is an object class representing an image of an access port serving a semi-permanent leased line which is located in an AN and connected to the LE via a V5 interface.

This managed object class is defined in EN 300 291-1 [25].

For V5 fault management the "ITU-T Recommendation M.3100 [7]": tmnCommunicationsAlarmInformation package should be instantiated with instances of this object class. Events as applicable should be reported by instances of this object class using the communicationsAlarm notification (see also annex A).

NOTE: In the absence of clear standards for event reporting on leased lines it is not appropriate to state mandatory requirements.

5.1.3 Communication path fragment

In this fragment the following object classes are used. They are defined in ITU-T Recommendation Q.824.5 [24]:

- "V5 communication channel (commChannel).

A V5 communication channel is an object class representing a V5 C-channel that multiplexes one or more C-paths.

Instances of this object class are used to contain commChannelCurrentData objects which represent V5 C-channel oriented traffic measurements.

5.1.4 Protection fragment

The following object classes shall be instantiated for fault and performance management in case of a V5.2 interface with more than one link. They are defined in ITU-T Recommendation Q.824.5 [24]:

- V5 protection group (v5ProtectionGroup);
- V5 protection unit (v5ProtectionUnit).

5.1.5 Performance fragment

For V5 specific traffic measurements a subclass of "ITU-T Recommendation Q.822 [9]": currentData shall be used to represent the traffic measurement data related to the V5 interface. Bearer channel as well as C-channel oriented measurements are each grouped as a set of measurements. For each group a single object class derived from the currentData object class is defined.

In addition to the object classes defined in this fragment the following object classes are used. They are defined in ITU-T Recommendation X.738 [18]:

- "ITU-T Recommendation X.738 [18]": simpleScanner;
- "ITU-T Recommendation X.738 [18]": scanReportRecord.

Instances of the scanner object class shall be used to produce the scan reports. Instances of scanReportRecord can be used to store the traffic data in a log.

The results of a measurement may also be stored in separate history objects. In this case, for bearer channel measurements as well as for communication channel measurements a single object class derived from "ITU-T Recommendation Q.822 [9]": historyData shall be used. Each object represents the results of a particular measurement interval.

5.1.5.1 Bearer channel current data

The bearer channel current data object class is a class of managed objects representing a set of V5.2 bearer channel oriented traffic measurements. It is a subclass of "ITU-T Recommendation Q.822 [9]": currentData.

This managed object class is defined in ITU-T Recommendation Q.831 [21].

Only one instance of this object class is contained in each instance of the "ITU-T Recommendation Q.824.5 [24]": v5Interface object class representing the V5.2 interface for which the measurements are to be activated. The measurements will then be performed on the basis of 15 minute intervals.

The following measurements are represented by attributes of this object class:

a) number of bearer channel allocations;

b) total sum of bearer channel holding times;

c) total sum of bearer channel in-service times;

d) unsuccessful bearer channel allocation attempts.

In addition to the inherited attributes, it has the attributes given in table 1.

Table 1

Name	M/C/O	Value set
"X.739": scanner Id	M	RDN
"Q.831": bearer channel allocations originating	M	single
"Q.831": bearer channel allocations terminating	M	single
"Q.831": bearer channel holding times originating	M	single
"Q.831": bearer channel holding times terminating	M	single
"Q.831": bearer channel in service times	M	single
"Q.831": unsuccessful bearer channel allocation attempt incoming	M	single
"Q.831": unsuccessful bearer channel allocation attempts internal	M	single
"Q.831": number of comm channels	M	single
"Q.831": number of V5 links	M	single

bearer channel allocations originating:	number of bearer channel allocations to originating calls.
bearer channel allocations terminating:	number of bearer channel allocations to terminating calls.
bearer channel holding times originating:	total sum of bearer channel allocation duration for originating calls.
bearer channel holding times terminating:	total sum of bearer channel allocation duration for terminating calls.
bearer channel in service times:	total sum of in-service times of the V5 time slots.
unsuccessful bearer channel allocation attempts incoming:	number of unsuccessful bearer channel allocation requests of incoming calls.
unsuccessful bearer channel allocation attempts internal:	number of unsuccessful bearer channel allocation requests of internal calls.
number of comm channels:	number of V5 C-channels provisioned for the V5 interface.
number of V5 links:	number of V5 links which comprise the V5 interface.

5.1.5.2 Bearer channel history data

The bearer channel history data object class is a class of managed objects representing the results of V5.2 bearer channel oriented traffic measurements. It is a subclass of "ITU-T Recommendation Q.822 [9]": historyData.

This managed object class is defined in ITU-T Recommendation Q.831 [21].

At the end of each current measurement interval an instance of this object class will be created. Instances of this object class may be contained in an instance of the object class bearer channel current data or in an instance of the object class "ITU-T Recommendation Q.824.5 [24]": V5 Interface.

In addition to the inherited attributes, it has the same attributes as the related bearer channel current data object class which are given in table 1.

5.1.5.3 Communication channel current data

The communication channel current data object class is a class of managed objects representing a set of V5 communication channel oriented traffic measurements. It is a subclass of "ITU-T Recommendation Q.822 [9]": current data.

This managed object class is defined in ITU-T Recommendation Q.831 [21].

Only one instance of this object class is contained in each instance of the "ITU-T Recommendation Q.824.5 [24]": V5 Interface object class representing the V5 interface for which the measurements are to be activated.
The measurements will then be performed on the basis of 15 minute intervals.

The following measurements are represented by attributes of this object class:

a) total sum of C-channel out-of-service times due to any reason;

b) total sum of C-channel out-of-service times due to far end blocking;

c) total sum of C-channel out-of-service times due to near end blocking;

d) number of C-channel outages;

e) number of transmitted or received octets in LAPV5 frames.

In addition to the inherited attributes, it has the attributes given in table 2.

Table 2

Name	M/C/O	Value set
"X.739": scanner Id	M	RDN
"Q.831": comm channel out of service any reason	M	single
"Q.831": comm channel out of service far end blocking	M	single
"Q.831": comm channel out of service near end blocking	M	single
"Q.831": comm channel outages	M	single
"Q.831": octets V5 frame	M	single
"Q.831": active standby	M	single

comm channel out of service any reason:	total sum of C-channel out of service duration due to any reason.
comm channel out of service far end blocking:	total sum of C-channel out of service duration due to far end blockings.
comm channel out of service near end blocking:	total sum of C-channel out of service duration due to near end blockings.
comm channel outages:	number of times a C-channel has been out of service.
octetsV5Frame:	number of octets transmitted or received within a LAPV5 frame.
active standby:	indicates if the C-channel is active or standby.

5.1.5.4 Communication channel history data

The communication channel history data object class is a class of managed objects representing the results of V5.2 communication channel oriented traffic measurements. It is a subclass of "ITU-T Recommendation Q.822 [9]": historyData.

This managed object class is defined in ITU-T Recommendation Q.831 [21].

At the end of each current measurement interval an instance of this object class will be created. Instances of this object class may be contained in an instance of the object class commChannelCurrentData or in an instance of the object class "ITU-T Recommendation Q.824.5 [24]": comm channel.

In addition to the inherited attributes, it has the same attributes as the related communication channel current data object class which are given in table 2.

5.1.6 Alarm surveillance fragment

Alarm surveillance functions are used to monitor or interrogate Network Elements (NEs) about events or conditions. The management information related to alarm surveillance is defined in ITU-T Recommendation Q.821 [8]. A summary is given in annex D.

5.1.7 Support fragment

5.1.7.1 Event report management

Event reporting management functions shall be used to establish and control the discrimination and the forwarding of event reports to other open systems. The management information related to event reporting is defined in ITU-T Recommendation X.734 [16].

5.1.7.2 Log control function

Log control functions may be used to store event reports and local system notifications into logs and to control this log process. The management information related to log control is defined in ITU-T Recommendation X.735 [17].

5.1.8 Test fragment

5.1.8.1 Access network ringback service treatment (anRbsTreatment)

The anRbsTreatment object class is a class of managed objects that represent the capability of an LE to support AN based tests initiated from the subscriber premises by dialling special service codes (ringback service).

This managed object class is defined in ITU-T Recommendation Q.835 [22].

Instances of this object class will be pointed at by instances of object classes representing the special service codes. In addition, instances of anRbsTreatment may be pointed at by instances of other object classes representing tones or announcements which are related to particular steps and results of the test procedure identified by the service code.

In addition to the inherited attributes, it has the attributes given in table 3.

Table 3

Name	M/C/O	Value set
"Q.835": anRbsTreatmentId	M	RDN
"Q.835": apply tone	M	set
"Q.835": apply ringing current	M	set
apply tone: indicates the last test results to be used for applying tones or announcements to each subscriber line under test. apply ringing current: indicates subscriber lines where a ringing current is currently applied.		

5.2 Attributes description

Refer to EN 300 377-1 [4] for the contents of this subclause.

5.3 Actions description

Refer to EN 300 377-1 [4] for the description of generic actions.

No specific actions are used.

5.4 Notifications description

Refer to EN 300 377-1 [4] for the description of generic actions.

The following specific notifications will be used. They are defined in ITU-T Recommendation Q.835 [22].

- offHook;
- onHook;
- timeOut.

The offHook notification indicates that a CPE under test has changed to the off-hook condition.

The onHook notification indicates that a CPE under test has changed to the on-hook condition.

The timeOut notification indicates that a procedure applying a tone or ringing current to a subscriber line under test has terminated.

6 Formal object class definitions

This clause specifies the object classes for all of the managed objects used in the management information model. These objects are defined by reference to other specifications.

6.1 V5 interface fragment

In this subclause, the definitions of the classes of the V5 interface fragment are specified by importing from other specifications. In this context, the IMPORTS clause specifies the object classes which can be instantiated in the scope of the present document.

```
BEGIN
IMPORTS
    v5Interface,
    v5Ttp,
    v5TimeSlot
FROM "ITU-T Recommendation Q.824.5 [24]";
END
```

6.2 Access port fragment

In this subclause, the definitions of the classes of the access port fragment are specified by importing from other specifications. In this context, the IMPORTS clause specifies the object classes which can be instantiated in the scope of the present document.

```
BEGIN
IMPORTS
    virtualAnalogueAccessR1,
    virtualBasicRateAccessR1,
    virtualPrimaryRateAccessR1,
    virtualLeasedAccessR1
FROM "EN 300 291-1 [25]";
END
```

6.3 Communication path fragment

In this subclause, the definitions of the classes of the communication path fragment are specified by importing from other specifications. In this context, the IMPORTS clause specifies the object classes which can be instantiated in the scope of the present document.

```
BEGIN
IMPORTS
    commChannel
FROM "ITU-T Recommendation Q.824.5 [24]";
END
```

6.4 Protection fragment

In this subclause, the definitions of the classes of the protection fragment are specified by importing from other specifications. In this context, the IMPORTS clause specifies the object classes which can be instantiated in the scope of the present document.

```
BEGIN
IMPORTS
    v5ProtectionGroup,
    v5ProtectionUnit
FROM "ITU-T Recommendation Q.824.5 [24]";
END
```

6.5 Performance fragment

In this subclause, the definitions of the classes of the performance fragment are specified by importing from other specifications. In this context, the IMPORTS clause specifies the object classes which can be instantiated in the scope of the present document.

```
BEGIN
IMPORTS
    simpleScanner,
    scanReportRecord
FROM "ITU-T Recommendation X.738 [18]"
    bearerChannelCurrentData,
    bearerChannelHistoryData,
    commChannelCurrentData,
    commChannelHistoryData
FROM "ITU-T Recommendation Q.831 [21]";
END
```

6.6 Alarm surveillance fragment

In this subclause, the definitions of the classes of the alarm surveillance fragment are specified by importing from other specifications. In this context, the IMPORTS clause specifies the object classes which can be instantiated in the scope of the present document.

```
BEGIN
IMPORTS
    currentAlarmSummaryControl,
    managementOperationsSchedule
FROM "ITU-T Recommendation Q.821 [8]";
END
```

6.7 Support fragment

In this subclause, the definitions of the classes of the support fragment are specified by importing from other specifications. In this context, the IMPORTS clause specifies the object classes which can be instantiated in the scope of the present document.

```
BEGIN
IMPORTS
    alarmSeverityAssignmentProfile,
    managedElement
FROM "ITU-T Recommendation M.3100 [7]"
    alarmRecord,
    attributeValueChangeRecord,
    eventForwardingDiscriminator,
    log
FROM "ITU-T Recommendation X.721 [11]";
END
```

6.8 Test fragment

In this subclause, the definitions of the new classes specific to the test fragment are specified by importing from other specifications. In this context, the IMPORTS clause specifies the object classes which can be instantiated in the scope of the present document.

```
BEGIN
IMPORTS
    anRbsTreatment
FROM "ITU-T Recommendation Q.835 [22]";
END
```

7 Protocol requirements

The protocol stack for use on this Q3 interface is the same as that specified in the companion standard on configuration management, EN 300 377-1 [4].

Annex A (normative): Specification of parameters for V5 specific alarm reports

Alarm reports shall be generated using the communicationsAlarm notification, as defined in ITU-T Recommendation X.721 [11], whenever one of the following events occur. The reports shall use the alarm report parameters as specified below.

The parameters are defined in ITU-T Recommendation Q.821 [8], ITU-T Recommendation X.721 [11] and in the present document, respectively.

The values for the parameter perceived severity as given below are defaults. They may be modified by means of the alarm event criteria function as specified in ITU-T Recommendation Q.821 [8].

NOTE: All parameters and parameter values given in the following list are mandatory in the context of V5 alarm reporting if not marked as optional.

A.1 Alarm reports related to the V5 interface object class

The alarm reports parameters related to the V5 interface object class are defined in EN 300 378-1 [23].

A.2 Alarm reports related to the V5 trail termination point object class

The alarm reports parameters related to the V5 trail termination point object class are defined in EN 300 378-1 [23].

A.3 Alarm reports related to the V5 time slot object class

The alarm reports parameters related to the V5 trail time slot object class are defined in EN 300 378-1 [23].

A.4 Alarm reports related to the virtual access port object class and subclasses

A.4.1 Control protocol errors

Event:	Port control protocol timer expiration errors
Reference:	V5.1 and V5.2: EN 300 324-1 [2]
Managed object class:	virtualAccessPortR1 and subclasses
Event type:	communicationsAlarm
Probable cause:	communicationsProtocolError (ITU-T Recommendation X.721 [11])
Specific problems:	portControlProtocolTimeOutError
Perceived severity:	minor

Event:	Port control protocol errors while "Out of Service"
Reference:	V5.1 and V5.2: EN 300 324-1 [2]
Managed object class:	virtualAccessPortR1 and subclasses
Event type:	communicationsAlarm
Probable cause:	communicationsProtocolError (ITU-T Recommendation X.721 [11])
Specific problems:	portControlProtocolError
Perceived severity:	warning

Event:	Port control protocol syntax errors
Reference:	V5.1 and V5.2: EN 300 324-1 [2]
Managed object class:	virtualAccessPortR1 and subclasses
Event type:	communicationsAlarm
Probable cause:	communicationsProtocolError (ITU-T Recommendation X.721 [11])
Specific problems:	portControlProtocolSyntaxError
Perceived severity:	warning

NOTE: Reporting of this event is optional.

Event:	Port control protocollayer 3 address errors
Reference:	V5.1 and V5.2: EN 300 324-1 [2]
Managed object class:	virtualAccessPortR1 and subclasses
Event type:	communicationsAlarm
Probable cause:	communicationsProtocolError (ITU-T Recommendation X.721 [11])
Specific problems:	portControlProtocolLayer3AddressError
Perceived severity:	warning
Additional information:	layer3PortAddress or envelopeFunctionAddress

A.4.2 PSTN protocol errors

Event:	PSTN protocol syntax errors
Reference:	V5.1 and V5.2: EN 300 324-1 [2]
Managed object class:	virtual analogue access R1
Event type:	communications alarm
Probable cause:	communications protocol error (ITU-T Recommendation X.721 [11])
Specific problems:	pstn protocol syntax error
Perceived severity:	warning

NOTE: Reporting of this event is optional.

Event:	PSTN protocol layer 3 address errors
Reference:	V5.1 and V5.2: EN 300 324-1 [2]
Managed object class:	virtualAnalogueAccessR1
Event type:	communicationsAlarm
Probable cause:	communicationsProtocolError (ITU-T Recommendation X.721 [11])
Specific problems:	pstnProtocolLayer3AddressError
Perceived severity:	warning

Event:	PSTN protocol timer expiration errors
Reference:	V5.1 and V5.2: EN 300 324-1 [2]
Managed object class:	virtualAnalogueAccessR1
Event type:	communicationsAlarm
Probable cause:	communicationsProtocolError (ITU-T Recommendation X.721 [11])
Specific problems:	pstnProtocolTimeOutError
Perceived severity:	minor

A.4.3 ISDN layer faults

Event:	ISDN layer 1 activation fault
Reference:	-
Managed object class:	virtualBasicRateAccessR1, virtualPrimaryRateAccessR1
Event type:	communicationsAlarm
Probable cause:	communicationsProtocolError (ITU-T Recommendation X.721 [11])
Specific problems:	isdnLayer1ActivationFault
Perceived severity:	warning

NOTE 1: This event indicates a layer 1 activation fault. It is only relevant for ISDN access with permanent layer 1 requested in the dChannelActivation attribute.

Event:	ISDN layer 2 fault
Reference:	CEPT Recommendation T/S 54-08 E [5]
Managed object class:	virtualBasicRateAccessR1, virtualPrimaryRateAccessR1
Event type:	communicationsAlarm
Probable cause:	communicationsProtocolError (ITU-T Recommendation X.721 [11])
Specific problems:	isdnLayer2Fault
Perceived severity:	warning

NOTE 2: This event is only relevant for ISDN access with permanent layer 2 requested in the dChannelActivation attribute.

Event:	ISDN layer 3 fault
Reference:	CEPT Recommendation T/S 54-08 E [5]
Managed object class:	virtualBasicRateAccessR1, virtualPrimaryRateAccessR1
Event type:	communicationsAlarm
Probable cause:	communicationsProtocolError (ITU-T Recommendation X.721 [11])
Specific problems:	isdnLayer3Fault
Perceived severity:	warning

Annex B (normative): V5 specific traffic measurement

B.1 Bearer channel oriented measurements at the V5 interface

The following bearer channel oriented traffic measurements may be performed whenever a V5.2 interface is used to connect subscriber accesses to the LE. The measurements shall be performed per V5 interface on the basis of 15 minute intervals.

B.1.1 Total number of bearer channel allocations bothway

This measurement gives the number of bearer channel allocations to user ports in the AN per V5 interface for calls terminating or originating at subscriber terminals which are connected to these ports.

In the AN bearer channel allocations are identified by a MDU-BCC (Allocation indication) sent from the BCC protocol entity to the resource manager and answered by a MDU-BCC (Allocation response complete) primitive.

Units: number of events.

NOTE: Measurement 1a is to performed in the AN only.

B.1.2 Measurement of the total number of bearer channel allocations for terminating traffic

This measurement gives the number of bearer channel allocations to user ports in the AN per V5 interface for calls terminating at subscriber terminals which are connected to these ports.

In the LE bearer channel allocations are identified by a MDU-BCC (Allocation request) sent from the resource manager to the BCC protocol entity and answered by a MDU-BCC (Allocation confirmation) primitive.

Units: number of events.

NOTE: Measurement 1b is to performed in the LE only.

B.1.3 Total number of bearer channel allocations for originating traffic

This measurement gives the number of bearer channel allocations to user ports in the AN per V5 interface for calls originating at subscriber terminals which are connected to these ports.

In the LE bearer channel allocations are identified by a MDU-BCC (Allocation request) sent from the resource manager to the BCC protocol entity and answered by a MDU-BCC (Allocation confirmation) primitive.

Units: number of events.

NOTE: Measurement 1c is to performed in the LE only.

B.1.4 Total sum of bearer channel holding times bothway

This measurement gives the total sum of bearer channel allocation duration for calls terminating or originating at subscriber terminals which are connected to user ports in the AN and can be reached via this V5 interface.

In the AN, the bearer channel allocation duration may start with the MDU-BCC (Allocation response complete) primitive and stop with the MDU-BCC (Deallocation response complete) primitive sent from the resource manager to the BCC protocol entity.

Units: seconds.

NOTE: Measurement 2a is to performed in the AN only.

B.1.5 Total sum of bearer channel holding times for terminating traffic

This measurement gives the total sum of bearer channel allocation duration for calls terminating at subscriber terminals which are connected to user ports in the AN and can be reached via this V5 interface.

In the LE, the bearer channel allocation duration starts with the MDU-BCC (Allocation confirmation) primitive and stops with the MDU-BCC (Deallocation confirmation) primitive received in the resource manager.

Units: seconds.

NOTE: Measurement 2b is to performed in the LE only.

B.1.6 Total sum of bearer channel holding times for originating traffic

This measurement gives the total sum of bearer channel allocation duration for calls originating at subscriber terminals which are connected to user ports in the AN and can be reached via this V5 interface.

In the LE, the bearer channel allocation duration starts with the MDU-BCC (Allocation confirmation) primitive and stops with the MDU-BCC (Deallocation confirmation) primitive received in the resource manager.

Units: seconds.

NOTE: Measurement 2c is to performed in the LE only.

B.1.7 Number of unsuccessful bearer channel allocation attempts for incoming traffic

This measurement gives the number of bearer channel allocation requests for calls from the transit network to the BCC protocol entity which do not receive a bearer channel.

These unsuccessful attempts are identified by a MDU-BCC (Allocation request) primitive sent from the resource manager to the BCC protocol entity which is not answered by a MDU-BCC (Allocation confirmation) primitive.

Units: number of events.

NOTE: Measurement 3a is to performed in the LE only.

B.1.8 Number of unsuccessful bearer channel allocation attempts for LE internal traffic

This measurement gives the number of bearer channel allocation requests for LE internal calls to the BCC protocol entity which do not receive a bearer channel.

These unsuccessful attempts are identified by a MDU-BCC (Allocation request) primitive sent from the resource manager to the BCC protocol entity which is not answered by a MDU-BCC (Allocation confirmation) primitive.

Units: number of events.

NOTE: Measurement 3b is to performed in the LE only.

B.1.9 Total sum of bearer channel in-service times

This measurement gives the total sum of in-service times of all V5 time slots which can be used for bearer channels during the measurement interval.

Units: seconds.

B.2 Communication channel oriented measurements at the V5 interface

The following C-channel oriented traffic measurements may be performed whenever a V5.1 or V5.2 interface is used to connect subscriber accesses to the LE. The measurements shall be performed per V5 C-channel on the basis of 15 minute intervals.

B.2.1 Duration of C-channel out-of-service due to any reason

This measurement gives the total sum of duration a C-channel has been out of service due to any reason.

Units: seconds/C-channel.

B.2.2 Duration of C-channel out-of-service due to near end blocking

This measurement gives the total sum of duration a C-channel has been out of service due to blockings initiated locally.

Units: seconds/C-channel.

B.2.3 Duration of C-channel out of service by far end blocking

This measurement gives the total sum of duration a C-channel has been out of service due to blockings initiated by the remote side.

Units: seconds/C-channel.

B.2.4 Number of C-channel outages

This measurement gives the total number of times a C-channel has been out of service due to any reason.

Units: number of events.

B.2.5 Number of LAPV5-EF frame octets on a C-channel

This measurement gives the total number of frame octets which have been transmitted or received within a LAPV5 frame in this C-channel including the overhead octets (see also EN 300 324-1 [2]). It includes the start flag of the LAPV5 frame and all octets between this and the stop flag. The stop flag and any idle flags are excluded from this measurement.

Units: number of events.

Annex C (informative): Task Information Base (TIB)

C.1 TMN management service "Fault management of V5 interfaces and associated user ports"

C.1.1 Description

Fault management of V5 interfaces and associated user ports is part of a management activity which is performed by the operator in order to detect failure conditions and to bring the customer access back to its normal state of operation whenever a deviation occurs. A customer access is considered as being that part of the local network which extends from the network termination equipment up to and including the exchange termination.

In this clause, only the parts of the activities are covered which are directly related to a V5 interface between a LE and an AN or to that part of the customer access which extends from the AN to the network termination equipment. An ISDN access extends to but does not include the T reference point. An analogue access extends to and may include the CPE.

C.1.2 Components of service (TIB A)

C.1.2.1 Failure detection

Observe or supervise the V5 interface and the customer line and collect relevant data in order to detect failures or degradations. Perform continuous or periodic checks of the system functions.

C.1.2.2 System protection

Initiate blocking of V5 interface or parts of it and user access ports. Initiate protection switching for the V5 interface (V5.2 only).

C.1.2.3 Failure information

Send alarms and event reports from the NE to TMN with failure information related to V5 interfaces and customer lines.

C.1.2.4 Failure localisation

Receive failure information from NEs which may be generated by performing tests and measurements on V5 interfaces or customer lines. Initiate additional fault localisation procedures and receive information from these procedures.

C.1.2.5 Fault correction

Replace faulty V5 interface equipment or user access port equipment with working replacements. Restart the V5 interface in order to eliminate NE internal problems.

C.1.2.6 Verification

Apply the appropriate tests and measurements to the replaced component before bringing it back to service.

C.1.2.7 Restoration

Restore the component to service. Unblock the blocked V5 interfaces or user access ports.

C.1.3 Management function list (TIB B)

C.1.3.1 Request status

TMN requests NE to send the current status information related to the V5 interface or to the user access port.

C.1.3.2 Initiate switch-over

TMN directs NE to switch a specified V5 communication channel:

- to a standby C-channel which then becomes the active C-channel; or
- to an active C-channel which will be pre-empted (this is valid for Q(LE) only).

C.1.3.3 Report automatic switch-over

NE notifies TMN that an automatic switch-over to a standby V5 communication channel has occurred.

C.1.3.4 Set service state

TMN directs NE to place a user access port, a V5 interface or parts of it in a specified service state, e.g. in service (available for use), standby (not for normal use), out of service (unavailable for use).

C.1.3.5 Alarm report

NE notifies TMN of alarm information concerning user access ports or V5 interfaces or parts of it.

C.1.3.6 Set alarm conditions

TMN directs NE to assign specific alarm parameters, modes and thresholds to alarms concerning user access ports or V5 interfaces or parts of it.

C.1.3.7 Apply test signals

TMN directs NE to send test signals to the terminating equipment or to the line circuit, e.g. ringing signals, dial pulses, meter pulses.

C.1.3.8 Remove test signals

TMN directs NE to remove the test signal sent by the apply function.

C.1.3.9 Request test results

TMN requests NE to report intermediate or final results from a test or measurement applied to a customer line or a line circuit.

C.1.3.10 Test result report

NE sends the results of a test or measurement applied to a customer line or a line circuit to TMN.

C.2 TMN management service "Performance management of V5 interfaces and associated user ports"

C.2.1 Description

Performance Management (PM) of V5 interfaces and associated user ports is part of a management activity which is employed in order to maintain the quality of service levels agreed with the customers. The activities undertaken in performance management are monitoring, analysis and problem alerting, diagnosis, optimization and control.

In this clause, only the parts of the activities are covered which are directly related to a V5 interface between a LE and an AN or to that part of the customer access which extends from the AN to the network termination equipment. An ISDN access extends to but does not include the T reference point. An analogue access extends to and may include the CPE.

C.2.2 Components of service (TIB A)

C.2.2.1 Performance monitoring

Initiate the collection of PM data concerning the load of a C-channel.

C.2.2.2 Performance information

Notify the TMN when PM thresholds have been crossed in the monitored ISDN digital section. Send PM data reports related to C-channel load to the TMN.

C.2.3 Management function list (TIB B)

C.2.3.1 Start/stop PM data

Start or stop the collection of C-channel load data in order to monitor the current load of a particular C-channel.

C.2.3.2 PM data report

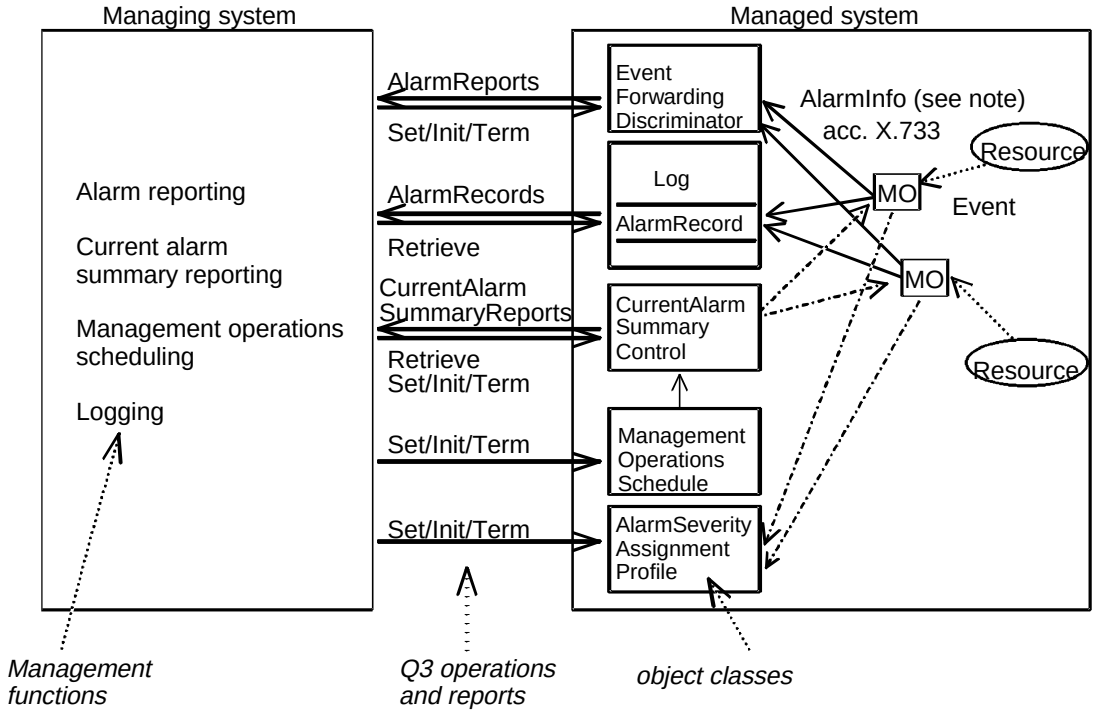
The NE sends a report containing the new transmission quality level to the TMN. It will be generated whenever a predefined threshold has been crossed in an ISDN digital section being monitored. The NE sends reports containing the current load of the C-channels to the TMN periodically or on demand.

Annex D (informative): Description of management functions

D.1 Alarm surveillance

D.1.1 Alarm surveillance functions

Alarm surveillance functions are a set of functions used to monitor or interrogate NEs about events or conditions (see figure D.1).



NOTE: Specified in the present document.

Figure D.1: ITU-T Recommendation Q.821 alarm surveillance scenario

Managed systems concerned with V5 fault management need to provide alarm reporting functions. Other alarm surveillance functions may be provided optionally. Event data is generated by a NE upon detection of an abnormal condition. Examples of such events are detection of transmission data errors (layer 1 failures) and V5 protocol entity errors. Alarm surveillance comprises the following functions specified in ITU-T Recommendation Q.821 [8].

D.1.1.1 Alarm reporting functions

Event data may be reported at the time of occurrence by means of alarm notifications, as specified in ITU-T Recommendation X.733 [15]. Control of the alarm reporting service is provided by mechanisms specified in ITU-T Recommendation X.734 [16].

D.1.1.2 Alarm summary functions

The NE may generate summary reports of alarm conditions and provide these reports to TMN on demand or on a scheduled basis.

D.1.1.3 Alarm event criteria functions

Particular alarm severity assignments may be specified which are to be used with alarm reports generated in the NE.

D.1.1.4 Alarm indication management functions

This function provides services to control alarm indicating devices in the NE via the Q interface.

D.1.1.5 Log control functions

Event data may be logged for further access in alarm log objects, as specified in ITU-T Recommendation X.735 [17].

D.1.2 Alarm reporting function

Alarms are specific types of notifications concerning detected faults or abnormal conditions. By use of the event report management function specified in ITU-T Recommendation X.734 [16] these notifications may result in alarm reports being sent to the TMN. In ITU-T Recommendation X.733 [15] five basic categories of alarms are specified. For V5 related alarms the communications alarm notification is used. Alarm notifications consist of a standardized set of parameters which provide information about the event to be reported, e.g. source, event type, probable cause, severity. Some of these parameters allow for application specific values to be added, for some even a specific type can be defined. These possibilities are used within the present document to provide V5 specific alarm information.

Description of alarm report parameters relevant for V5 related alarm reports:

D.1.2.1 Event type

Five basic categories of alarm are specified. These are:

- communications alarm type, associated with procedures required to convey information from one point to another;
- quality of service alarm type, associated with degradation in the quality of a service;
- processing error alarm type, associated with software or processing faults;
- equipment alarm type, associated with an equipment fault;
- environmental alarm type, associated with conditions relating to an enclosure in which the equipment resides.

D.1.2.2 Probable cause

This parameter further qualifies the probable cause of an alarm. The probable cause values for notifications is indicated in the behaviour clause of the object class definition. The syntax of the probable causes is an ASN.1 type object identifier. Standard probable cause values that have wide applicability across managed object classes are defined in ITU-T Recommendation X.733 [15]. Other probable causes may be defined in other specifications and registered using the procedures defined for ASN.1 object identifier values in CCITT Recommendation X.208 [10].

D.1.2.3 Specific problems

This parameter identifies further refinements to the probable cause of an alarm. The syntax of the specific problems is an ASN.1 type object identifier.

D.1.2.4 Perceived severity

This parameter defines six severity levels, which provide an indication of how it is perceived that the capability of the managed object has been affected. These are:

- critical, indicates a service affecting condition which needs immediate corrective action;
- major, indicates a service affecting condition which needs urgent corrective action;
- minor, indicates a non-service affecting condition and that corrective action is advisable to prevent more serious faults;
- warning, indicates a potential or impending service affecting fault before any significant effects have been felt. Further diagnostic actions should be taken to prevent more serious effects;
- indeterminate, indicates that the severity level cannot be determined;
- cleared, indicates the clearing of one or more previously reported alarms.

D.1.2.5 Monitored attributes

This parameter defines one or more attributes of the managed object and their corresponding values at the time of the alarm.

D.1.2.6 Additional information

Managed systems may provide additional information like alarm status, related log IDs and a list of suspected objects. In ITU-T Recommendation Q.821 [8] according to the basic alarm categories five alarm information packages are introduced which specify this additional information. In the context of V5 alarm reporting it is used for example to report a suspect layer 3 address whenever an address error has been detected.

For the description of other optional parameters of the alarm report see ITU-T Recommendation X.733 [15].

Object classes which are specified in the present document to be used for V5 fault management need to contain the tmnCommunicationsAlarmInformationPackage. This package constitutes the communicationsAlarm notification with the parameters logRecordId, correlatedRecordName, suspectObjectList and the attributes alarmStatus and currentProblemList.

D.2 Performance management

D.2.1 Performance management functions

Performance management as defined in ITU-T Recommendation Q.822 [9] comprises the following functions:

D.2.1.1 Performance management data collection functions

PM data collection refers to the ability for the NE to collect the various PM data relating to a single monitored entity in that NE. The following specific functions are associated with the collection activity:

a) assign PM data collection interval;

b) suspend/Resume PM data collection;

c) reset PM data;

d) schedule PM data collection.

D.2.1.2 Performance management data storage functions

PM data storage refers to the optional capability for the NE to store historical PM data on each monitored entity for a prescribed time duration. The NE can also store summarized or statistical data derived from various monitored entities. When this capability is available, the following specific functions are associated with the storage activity:

a) assign PM history duration;

b) screen PM data storage;

c) remove PM history data.

D.2.1.3 Performance management thresholding functions

PM thresholding refers to the ability for the NE to inform the TMN manager of any threshold crossing. It also provides the TMN manager with the means for establishing thresholding criteria. When this capability is available, the following specific functions are associated with the thresholding activity:

a) assign PM threshold;

b) report PM threshold violation.

D.2.1.4 Performance management data reporting functions

PM data reporting refers to the optional capability for the NE to report PM data on a scheduled basis, or as a result of a spontaneous request from the TMN manager. A report may contain data from a given monitored entity, or it can contain summarized data or data derived statistically from a set of monitored entities. The following specific functions are associated with the reporting activity:

a) request PM data;

b) report PM data;

c) allow/Inhibit PM data reports;

d) screen PM data reports.

D.2.2 Performance management model

The object model for performance management is shown in figure D.2. Current PM data is collected for a monitored object by a currentData object class or its subclasses. Instances of the currentData object class or its subclasses are contained by the monitored object. At the end of each performance interval, the duration of which is determined by the granularityPeriod attribute, a summary report (scanReport) may be issued and a historyData object may be created to record the performance measurements for that interval. Thresholds may be established by use of the thresholdData object. When a threshold is violated by a performance measurement an alarm is emitted by the currentData object and logged as required. Performance measurements can be aggregated or statistically summarized by use of Scanner objects as defined in ITU-T Recommendation X.738 [18].

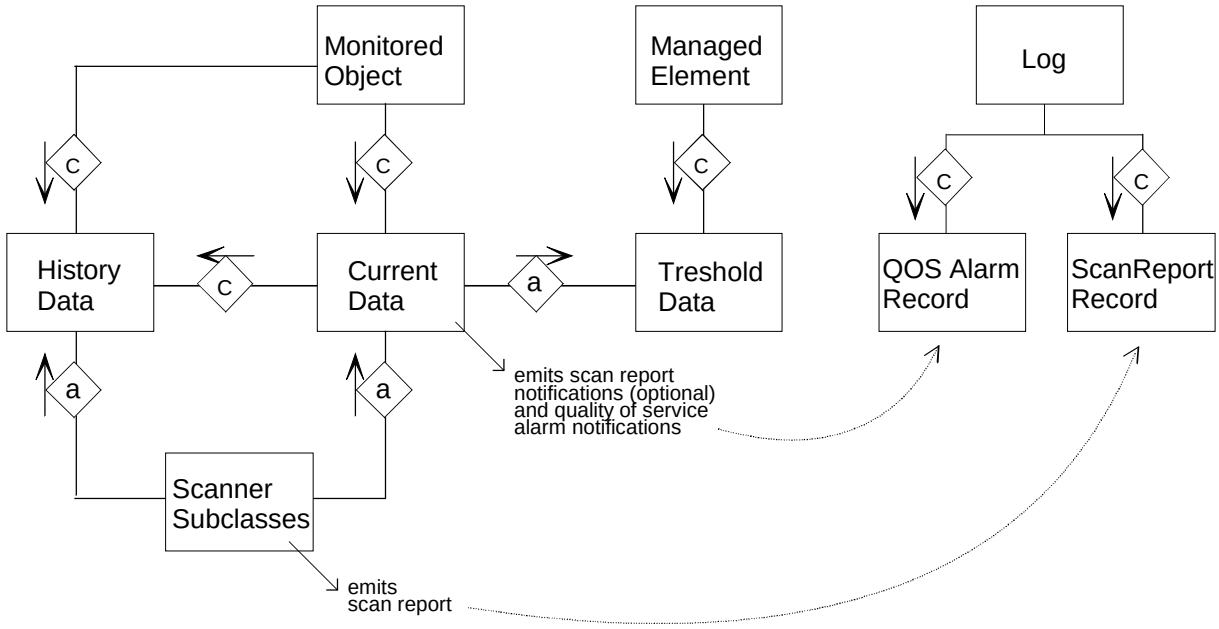


Figure D.2: Q.822 Object model for performance management

D.2.2.0 Monitored object

This object is the managed object for which the performance measurements are being collected. It represents the resource being measured (e.g. V5 communication channel).

D.2.2.1 CurrentData object

This object contains the measurements for the resource being monitored for a specified time interval (e.g. 15 min.). In most cases the instantiated managed object will be an instance of a subclass of currentData. This subclass will have performance measurement attributes appropriate to the resource represented by the class of the monitored object (e.g., V5 performance measurements). At the end of each interval the currentData object may 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 object be configured such that this notification is logged). Also, at the end of each interval a historyData object may be created containing the same attributes as the currentData object with values of the performance measurements at the end of the interval.

The currentData object may contain a pointer to a thresholdData object. If any of the thresholds (defined in the referenced thresholdData object) are violated, a quality of service alarm notification is emitted by the currentData object. The resulting alarm record may be logged.

The generic currentData object class should not be used for technology specific interfaces where standardized technology specific subclasses of currentData exist.

D.2.2.2 HistoryData object

This object will contain a copy of the performance management and other selected attributes that are present in the currentData object at the end of the current interval (e.g. 15 min.). A new instance of this object class is created at the end of each interval.

D.2.2.3 ThresholdData object

This object contains a set of threshold values which correspond to a set of measurements defined for one or more classes of currentData. The thresholdData object is referenced from the currentData object by a pointer. If any of the thresholds specified in the thresholdData object are violated by the measurements in the referencing currentData object the currentData object immediately issues a quality of service alarm notification.

D.2.2.4 Scanners

Any of the scanner objects which are defined in ITU-T Recommendation X.738 [18] may be used to scan the contents of either the currentData or historyData objects. These scanners may be used to aggregate sets of measurements from a number of currentData objects representing a number of different monitored objects and/or a number of historyData objects for one or more monitored entities. These scanner objects may simply aggregate the measurements into a scanReport notification for bulk transfer to a managing system, or they may be used to perform statistics on the measurements (e.g. mean, variance, etc.) for inclusion in a scanReport which can be sent to the managing system or stored in the log.

Scanners used to aggregate measurements include: simpleScanner and dynamicSimpleScanner. Those used to perform statistics include: meanScanner, meanVarianceScanner and minMaxScanner.

NOTE: The historyData object provides more flexible access to performance measurements than the scanReport, since the measurements are held in individual attributes, rather than a single complex attribute. The use of historyData also provides a closer association of the contained information with the monitored object that does the scanReport. In the generic log there is no mechanism to restrict log records in a similar way to historyData (which may be implicitly deleted after a number of intervals).

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