INTERNATIONAL TELECOMMUNICATION UNION

ITU-T Q.837.1

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

(02/2004)

SERIES Q: SWITCHING AND SIGNALLING

Q3 interface

SDH-DLC functional requirements for the network and network element views

ITU-T Recommendation Q.837.1

ITU-T Q-SERIES RECOMMENDATIONS

SWITCHING AND SIGNALLING

SIGNALLING IN THE INTERNATIONAL MANUAL SERVICE	Q.1–Q.3
INTERNATIONAL AUTOMATIC AND SEMI-AUTOMATIC WORKING	Q.4–Q.59
FUNCTIONS AND INFORMATION FLOWS FOR SERVICES IN THE ISDN	Q.60–Q.99
CLAUSES APPLICABLE TO ITU-T STANDARD SYSTEMS	Q.100–Q.119
SPECIFICATIONS OF SIGNALLING SYSTEMS No. 4, 5, 6, R1 AND R2	Q.120–Q.499
DIGITAL EXCHANGES	Q.500–Q.599
INTERWORKING OF SIGNALLING SYSTEMS	Q.600–Q.699
SPECIFICATIONS OF SIGNALLING SYSTEM No. 7	Q.700–Q.799
Q3 INTERFACE	**Q.800–Q.849**
DIGITAL SUBSCRIBER SIGNALLING SYSTEM No. 1	Q.850–Q.999
PUBLIC LAND MOBILE NETWORK	Q.1000–Q.1099
INTERWORKING WITH SATELLITE MOBILE SYSTEMS	Q.1100–Q.1199
INTELLIGENT NETWORK	Q.1200–Q.1699
SIGNALLING REQUIREMENTS AND PROTOCOLS FOR IMT-2000	Q.1700–Q.1799
SPECIFICATIONS OF SIGNALLING RELATED TO BEARER INDEPENDENT CALL CONTROL (BICC)	Q.1900–Q.1999
BROADBAND ISDN	Q.2000–Q.2999

For further details, please refer to the list of ITU-T Recommendations.

ITU-T Recommendation Q.837.1

SDH-DLC functional requirements for the network and network element views

Summary

This Recommendation defines management functions that are to be supported at network level for the SDH-DLC system. These management functions are selected from ITU-T Rec. M.3400 and adapted for managing these technologies. These management functions are applicable for the interface between Network Management and Element Management systems. These functions are to form the basis in developing the requirements and analysis according to M.3020 methodology to develop the protocol neutral information model in a future Recommendation.

Source

ITU-T Recommendation Q.837.1 was approved on 13 February 2004 by ITU-T Study Group 4 (2001-2004) under the ITU-T Recommendation A.8 procedure.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g. interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

CONTENTS

		Page
1	Scope	1
2	References	1
3	Definitions	2
	3.1 Terms imported from other ITU-T Recommendations	2
	3.2 New terms	2
4	Abbreviations	3
5	Conventions	4
6	General overview	4
	6.1 Operations architecture	4
	6.2 Management layers for SDH and DLC networks	4
7	Management requirements	5
	7.1 Common management requirements	5
	7.2 Element management level (NE view) requirements	6
	7.3 Network management level requirements	10
	7.4 Element management level for NMS-EMS interface requirements	13
Appendix I – Candidate of managed entities		14
	I.1 Network element managed entities	15
	I.2 Network level managed entities	16
Appendix II – Table of managed entities		17

ITU-T Recommendation Q.837.1

SDH-DLC functional requirements for the network and network element views

1 Scope

This Recommendation specifies the functional requirements for the management of SDH-DLC systems at a reference point beyond an element management layer. These requirements are based on ITU-T Rec. M.3400 and defined from the perspective of an operator of a network management system using a combination of network element and network level views. The aim of these requirements is to support the integration of DLC and SDH technologies for fibre-access networks in a multi-vendor environment. The goal of these requirements is to perform the operation, maintenance and administration of these networks in an efficient manner. The management services supported by these requirements include customer administration, network provisioning, quality of service, network performance and maintenance management as defined by ITU-T Rec. M.3200. These functional requirements would be used to develop the use cases and protocol-neutral information model according to M.3020 methodology in a future Recommendation.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[1] ITU-T Recommendation M.3010 (2000), *Principles for a telecommunications management network*.

[2] ITU-T Recommendation M.3020 (2000), *TMN interface specification methodology*.

[3] ITU-T Recommendation M.3100 (1995), *Generic network information model* (plus amendments).

[4] ITU-T Recommendation M.3400 (2000), *TMN management functions*.

[5] ITU-T Recommendation G.774 (2001), *Synchronous digital hierarchy (SDH) – Management information model for the network element view*.

[6] ITU-T Recommendation G.783 (2004), *Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks*.

[7] ITU-T Recommendation G.805 (2000), *Generic functional architecture of transport networks*.

[8] ITU-T Recommendation G.902 (1995), *Framework Recommendation on functional access networks (AN) – Architecture and functions, access types, management and service node aspects*.

[9] ITU-T Recommendation Q.834.1 (2001), *ATM-PON requirements and managed entities for the network element view*.

[10] ITU-T Recommendation Q.834.2 (2001), *ATM PON requirements and managed entities for the network view*.

[11] ITU-T Recommendation X.721 (1992) | ISO/IEC 10165-2:1992, *Information technology – Open Systems Interconnection – Structure of management information: Definition of management information*.

[12] ITU-T Recommendation Q.831 (1997), *Fault and performance management of V5 interface environments and associated customer profiles*, plus Corrigendum 1 (2001).

[13] ITU-T Recommendation Q.832.1 (1998), *VB5.1 management*, plus Corrigendum 1 (2001).

[14] ITU-T Recommendation Q.816 (2001), *CORBA-based TMN services*.

[15] ITU-T Recommendation M.3120 (2001), *CORBA generic network and network element level information model*.

[16] ITU-T Recommendation X.780 (2001), *TMN guidelines for defining CORBA managed objects*.

[17] TeleManagement Forum TMF513 (2002), *Multi-Technology Network Management Business Agreement*.

[18] ETSI EN 300 371 V1.3.2 (2001-02), *Telecommunications Management Network (TMN); Plesiochronous Digital Hierarchy (PDH) information model for Network Element (NE) view*.

3 Definitions

3.1 Terms imported from other ITU-T Recommendations

This Recommendation uses the following terms:

- Element Management System (EMS) – Imported from ITU-T Rec. M.3100;
- Network Element (NE) – Imported from ITU-T Rec. M.3100;
- Operations System Function (OSF) – Imported from ITU-T Rec. M.3100;
- Network Element Layer (NEL) – Imported from ITU-T Rec. M.3100;
- Element Management Layer (EML) – Imported from ITU-T Rec. M.3100;
- Network Management Layer (NML) – Imported from ITU-T Rec. M.3100;
- Element/Network/Service Management System – Imported from ITU-T Rec. M.3100;
- Data Communications Network (DCN) – Imported from ITU-T Rec. M.3100;
- Customer – Imported from ITU-T Rec. M.3100;
- Digital Cross Connect (DXC) – Imported from ITU-T Rec. G.783;
- Network Termination (NT) – Imported from ITU-T Rec. G.960;
- Synchronous Digital Hierarchy (SDH) – Imported from ITU-T Rec. G.707/Y.1322;
- Access Network (AN) – Imported from ITU-T Rec. G.902;
- Add/Drop Multiplexer (ADM) – Imported from ITU-T Rec. G.783.

3.2 New terms

This Recommendation defines the following terms:

3.2.1 central terminal (CT): A Central Terminal (CT) provides the network-side interface of the OAN; it is connected to one or more Remote Terminals. A Central Terminal may consist of a HOM or ADM providing the network-side interface of the DLC system either integrated or separately.

3.2.2 digital loop carrier (DLC): An integrated access system containing a number of point-to-point communication links between a network side and user side supported by optical access transmission systems.

3.2.3 optical access network (OAN): The set of access links sharing the same network-side interfaces and supported by optical access transmission systems. The OAN may include a number of ODNs connected to the same OLT.

3.2.4 remote terminal (RT): The termination of the optical access network element that provides the user-side interface and connected to the ODN.

4 Abbreviations

This Recommendation uses the following abbreviations:

CT	Central Terminal
CTP	Connection Termination Point
DCN	Data Communications Network
DLC	Digital Loop Carrier
EM	Element Management
EML	Element Management Layer
EMS	Element Management System
ITU	International Telecommunication Union
ME	Managed Entity
MIB	Management Information Base
MSP	Multiplex Section Protection
NE	Network Element
NEL	Network Element Layer
NML	Network Management Layer
NMS	Network Management System
NT	Network Termination
OAM	Operations, Administration and Maintenance
OAN	Optical Access Network
PM	Performance Management
QoS	Quality of Service
RT	Remote Terminal
SDH	Synchronous Digital Hierarchy
SNI	Service Network Interface
SNC	Sub-Network Connection
SNCP	Sub-Network Connection Protection
TMN	Telecommunications Management Network
TP	Termination Point
UML	Unified Modelling Language

UNI User Network Interface

5 Conventions

The following notations are used within this Recommendation:

[M] Mandatory. These requirements shall be supported on the interface.

[O] Optional. These requirements may be supported.

6 General overview

6.1 Operations architecture

This Recommendation addresses the management functions of SDH-DLC subnetworks.

SDH-DLC network elements include CT, RT, and ADM as shown in Figure 1. The EMS shown in the figure manages the network elements forming the SDH-DLC access network. The EMS manages the internal details of the network elements.

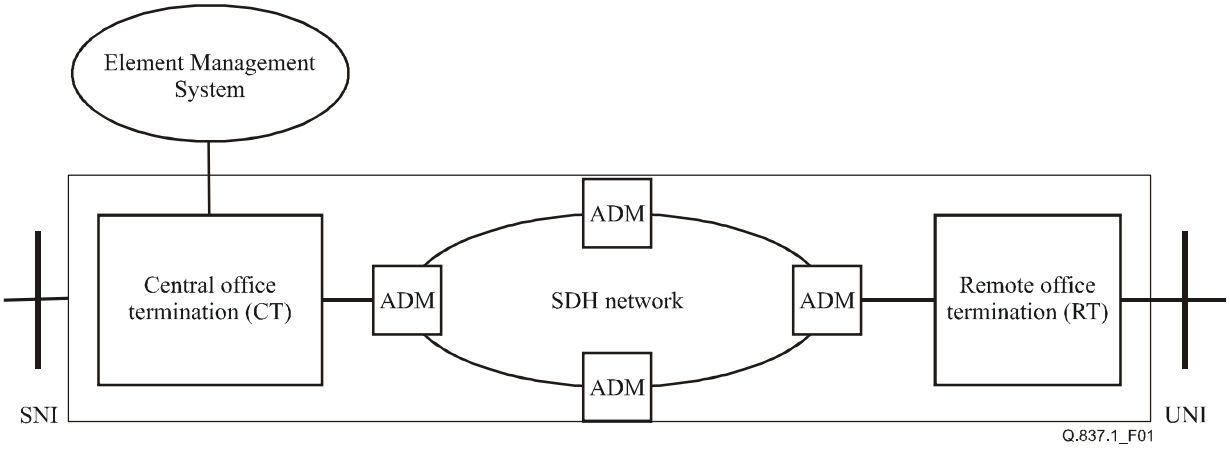

Figure 1/Q.837.1 – SDH and DLC network elements

6.2 Management layers for SDH and DLC networks

Figure 2 shows logical separation of functionalities in the management systems. The element management system shown is used to manage the individual network elements supporting DLC and SDH technologies. One or more systems may be required depending on the different supplier products and geographic distribution of the elements in the network. The goal of these systems is to manage elemental level (NE view) information specific to the network element. The network level management system shown as NMS in the figure represents an integrated management across the different technology and supplier systems. The logical representation shown by NMS may be realized by one or more physical interfaces. This Recommendation defines the requirements for the integrated management at the network level and in addition includes those at the element level required for the integrated management. These requirements shall be realized through standard protocols used for communication between NMS and EMS. These requirements support a multi-supplier environment in an operator network.

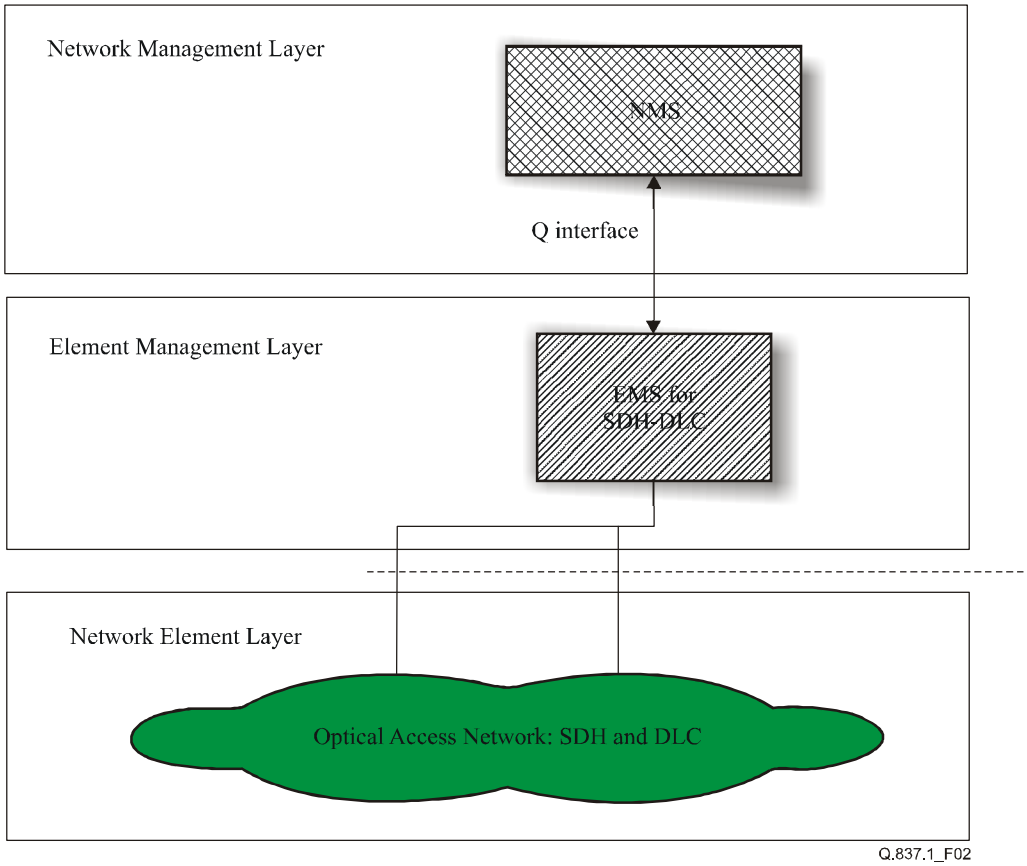

Figure 2/Q.837.1 – SDH and DLC management layers

7 Management requirements

This clause defines the management requirements for Network Management and Element Management levels, as shown in the logical architecture. The requirements are subdivided into the Fault, Configuration, Performance and Security management functional areas. These functions derived from ITU-T Rec. M.3400 are customized to meet the needs of SDH-DLC sub-network management. In the following requirements the term "SDH-DLC equipments" is used to refer to the various network elements (ADM, DXC, RT and CT), which are part of the access network. This Recommendation includes the requirements for the management of transport resources at network level, NE level and the subset of NE level appropriate for network level.

7.1 Common management requirements

This clause defines requirements that are applicable for integrated management of the network level and appropriate NE level.

7.1.1 Event management

Event management refers to the broad set of functions associated with the detection, isolation, and reporting of different events that occur in the optical access network. These functions can be used for example to detect and report failure events in the context of fault management:

– event reporting (detection and reporting);

– event processing (correlation and filtering);

– event logging.

7.1.2 Security management

The following functions are required in the security management:

1) Access to management functions and data at any level either by users or external systems shall require authentication and access control.

2) Users or external systems shall be authenticated through a challenge-response mechanism. This mechanism involves authentication through the use of identification and passwords. The mechanism may include use of devices such as smart cards for user identification.

3) It shall be possible to configure the identification, the minimum length of the password, the expiry time of the password, the maximum allowed attempts "m" to enter the password and the retry expiry timeout for each individual user or external system.

4) A user failing "m" attempts to enter the correct password shall be denied further attempts to gain access until expiry of the retry timeout. In this case a security violation event shall be logged and a message shall be displayed, if appropriate, to indicate that access has been denied.

5) Passwords shall not be echoed when entered and shall be encrypted if transmitted over any communications link.

6) It shall be possible to configure the access to the management functions and data available to a user or external system. The access control shall be based on read/write/modify/ execute/delete privileges, geographic location, time period over which access is allowed, and user profile and/or system name.

7) Illegal attempts to access functions and/or data shall be reported as a security violation. All accesses shall be logged.

8) If a security violation is detected, the security function shall isolate the user or external system to prevent any further access attempts.

7.1.3 Logs

The following functions are required for logs:

1) When logs overflow, if wrap mode has been set, it shall overwrite on a first-in first-out basis.

2) It shall be possible to archive logs periodically using back-up mechanisms. Archiving shall not affect current logs.

3) It shall be possible to read all logs (current or archived) from the user interface.

7.2 Element management level (NE view) requirements

This clause includes the management functions defined in ITU-T Rec. M.3400 for element level management appropriate for this application. In addition it includes functions performed by the EMS for possible communication to the NMS. Manager refers to EMS and Agent refers to SDH and DLC-NE.

7.2.1 Configuration management

The following functions are required for configuration management:

1) [M] The Manager shall be able to request to the Agent the current configuration of each entity and receive the report of the current configuration.

2) [M] The Agent shall be able to report the configuration to the Manager for each entity, such as status, capacity of the entity, optional parameters, type of entity (in sufficient detail for the Manager to identify) and the version and revision of the version of hardware and software.

3) [M] The Agent shall be able to notify the presence of a newly installed entity, disconnection of an entity, beginning the monitoring of the newly installed entity, change of unequipped and equipped status of the entity.

4) [M] The Manager shall be able to direct the Agent to place the specified entity in one of the following states: in-service (available for use), out-of-service (unavailable for use), standby (not faulty but not performing normal function), reserved.

5) [M] The Manager shall be able to request that the Agent shall report the identity of each assigned entity. The request may be for a specified entity or for all equipped entities.

6) [M] The Manager shall be able to direct the Agent to set parameters associated with a specified entity.

7) [M] The Manager shall be able to direct the Agent to set the Agent system clock to current calendar, date and time.

8) [M] The Manager shall be able to direct the Agent to make a back-up copy of the designated Agent database file for purposes of archiving for future restoration.

9) [M] The Manager shall be able to direct the Agent to terminate administration process between a Manager and an Agent.

10) [M] The Manager shall be able to direct the Agent to assign user access and functional capability.

11) [M] The Manager shall be able to configure a new database that is related to an Agent. This may also include loading a new program related to the Agent.

12) [M] The Manager shall be able to add, change or delete one or more records in the database of an Agent.

13) [M] The Manager shall be able to read all or part of its database contents in an Agent.

14) [M] The Manager shall be able to keep a copy of all or part of the database of an Agent. In case of memory failure in the Agent, the Manager downloads the back-up copy to the Agent.

15) [M] The Manager shall be able to create cross-connects within an SDH and DLC network element.

16) [M] The Manager shall be able to create, modify, display and delete the logical representations of the resources required to manage the network and services. All necessary network and service parameters shall be supplied in the appropriate request.

17) [M] The Manager shall maintain a database containing the logical representations, state and relationship of the resources being managed.

18) [M] It shall be possible to create the logical resources in the Manager's database without the need for equipment to be physically present in the network.

19) [M] The Manager shall maintain and respond to state and relationship information changes for all resources.

20) [O] The Agent shall automatically allocate the required resources if they are not identified in the provision request.

21) [O] If all spare and installed resources are in use, the Agent shall use the next available spare, and not installed, resources.

22) [M] If there are no spare resources awaiting installation, then the Agent shall propose a list of the equipment that needs to be installed to allow the request to be fulfilled. The equipment list shall indicate:

- the type of equipment to be installed (ADM, CT, RT, etc.);
- the location where it is to be installed (rack, shelf, slot, etc.);

– the software and hardware versions that are compatible with the existing version of installed hardware.

23) [M] Each equipment list shall be stored in the Manager until an event is received from the Agent to indicate that the network equipment has been physically installed and has been correctly authenticated.

24) [M] The Manager shall be able to request the Agent to modify service parameters (such as bit rate, service type, error checking as applicable) for individual UNI(s).

25) [M] The Manager shall be able to access the service feature setting and the capabilities defined by those settings.

26) [M] The Manager shall support download of configuration information when equipment is installed. Where multi-service equipment is used, it shall be possible to download service-specific software.

27) [O] The Manager shall determine the increase or decrease in capacity based on the equipment installation event report from the NE. The inventory information in this event report shall be recorded in the Manager's database. This information shall only be deleted when the logical resource has been marked for removal and the equipment is physically removed from the network.

28) [M] All requests to create, modify and delete network resources shall be logged. Each request shall be recorded with the identity of the source that originated the request and the date of the request.

29) [M] Restoration of network element information from storage media shall be accomplished through software download from the Manager to the NE via the data communications network.

7.2.2 Fault management

The following functions are required for fault management:

1) [M] The Agent shall be able to notify the Manager of alarm information upon the occurrence of an alarm.

2) [M] The Manager shall be able to specify to the Agent the destination address(es) for a specified set of alarm reports.

3) [M] The Manager shall be able to instruct the Agent to assign filtering criteria for alarm reporting.

4) [M] The Manager shall be able to request the Agent to send the current assignment of filtering criteria for alarm reporting; the Agent responds with the current assignment of the specified attributes.

5) [M] The Manager shall be able to instruct the Agent to allow or inhibit alarm reports to the Manager.

6) [M] The Manager shall be able to request the Agent to send specified alarm information history.

7) [M] Fault reports shall accurately indicate the cause, severity, time and location of conditions detected by the network down to specific replaceable equipment. All fault reports shall be logged.

8) [M] The Manager shall receive alarms, for example, corresponding to various faults in the SDH-DLC network equipments, environmental conditions within the network elements.

9) [M] The Agent shall be able to report the results of a diagnostic sequence to the Manager. It may be used in conjunction with the request and stop functions and has applications where it may be necessary or desirable to repeat diagnostic tests for a period of time to "catch" a failure.

10) [M] The Manager shall be able to direct the Agent to establish a routine schedule for the initiation of a diagnostic.

11) [M] The Manager shall be able to request the Agent to report the current schedule of diagnostic.

12) [M] The Agent shall be able to send the current schedule of diagnostic.

13) [M] The Manager shall be able to direct the Agent to start or stop a specific trace.

14) [M] The Agent shall be able to automatically report to the Manager the results of a trace.

15) [M] The Manager shall be able to direct the Agent to start or stop an audit.

16) [M] The Agent shall be able to automatically report to the Manager the results of an audit.

17) [M] The Manager shall be able to direct the Agent to establish a specified schedule for a given audit.

18) [M] The Manager shall be able to request the Agent to send the current audit schedule. The Agent responds with the audit schedule.

19) [M] The Manager shall be able to perform scheduled routine tests, start/stop routine tests and report routine test schedule.

20) [M] It shall be possible for the Manager to block and unblock resources that provide services for maintenance function. Whilst a resource is blocked for maintenance purposes it shall not be possible to use the service supported by that resource.

7.2.3 Performance management

The following functions are required for performance management:

1) [M] The Manager shall be able to request the Agent to send current performance management (PM) data.

2) [M] The Agent shall be able to send performance data to the Manager. It may be generated routinely by the Agent, sent upon demand by the Manager or by exception when a parameter threshold has been exceeded.

3) [M] The Manager shall be able to direct the Agent to start/stop the collection of PM data. When a collection function is activated, it shall be possible to monitor from the Manager and specify a time period of collection.

4) [O] The Manager shall provide performance data on demand via the user interface or shall generate performance reports periodically according to a pre-established schedule.

5) [M] The Manager shall be able to direct the Agent to establish a schedule for the reporting of PM data.

6) [O] The Manager shall be able to direct the Agent to send the current PM data reporting schedule. The Agent responds with the schedule.

7) [M] The Manager shall be able to direct the Agent to set or change the PM parameter threshold.

8) [O] The Manager shall be able to instruct the Agent to suspend/resume the PM data collection activity for a given monitored entity or set of monitored entities.

9) [M] The Manager shall be able to instruct the Agent to originate historical data based on some screening criteria (e.g., suppress "all-zero" data).

10) [M] The Manager shall be able to instruct the Agent about the duration of the PM data collection interval for a given entity or set of entities.

11) [M] The Manager shall be able to retrieve the current PM parameter threshold.

12) [M] The Agent shall be able to report PM data to the Manager.

7.3 Network management level requirements

This clause includes the management functions defined in ITU-T Rec. M.3400 for network level management appropriate for this application. These functions are used to define the use cases and analysis for the SDH-DLC management interface between NMS and EMS. In the following, Manager refers to NMS and Agent refers to EMS.

7.3.1 Configuration management

The following functions are required for configuration management:

1) [M] The Agent shall provide access to information about the coordination of hardware and software for new installations, upgrades, and maintenance changes across the network.

2) [M] The Agent shall provide access to information about installation status and supports notification of completion after acceptance testing as required. It also supports notification of failure to meet successful completion criteria, with the reason for unsuccessful completion. It also supports summary and exception reports for the management of installation jobs.

3) [M] The Agent shall support requests for network resources and responds with selected resources and the associated service features. It provides access to a network resource database. It supports requests for selection and assignment of resources and service features that meet any designated selection criteria. Network resources include facilities, switching and software such as service logic programs needed to provide service for a customer.

4) [M] The Agent shall support requests for access circuit design. It supports responses that state the access points from the customer to the network.

5) [M] The Agent shall support requests for a particular set of cross-connections required for implementation of a circuit design. It supports actions to request the cross-connections to be established in NEs or groups of NEs.

6) [M] The Agent shall send an indication of creation to the Manager when a circuit resource is created.

7) [M] The Agent shall send an indication of deletion to the Manager when a circuit resource is deleted.

8) [M] The Agent shall send an indication of configuration change to the Manager when a circuit resource is changed.

9) [M] The Agent shall send an indication of service state change to the Manager when the service state of circuit resource is changed.

10) [M] The Manager shall be able to request for a path through an NE or a group of NEs that will allow for connection with other NEs or network interfaces to establish an end-to-end circuit connection. Selects and binds resources to form the required connection.

11) [M] The Manager shall be able to request the Agent to transmit the current status of automatic transmission restoration.

12) [M] The Manager shall be able to request the Agent to Autodiscover NEs and PlugInUnits.

13) [M] The Manager shall be able to request NE synchronization.

14) [M] The Manager shall be able to register the CT and RT in the networks.

15) [M] The Manager shall be able to create, activate, deactivate, modify, and delete sub-network connections, for end-to-end service provisioning. All necessary parameters shall be supplied in the appropriate request. The Agent shall provide access to information about the management of individual NE connections and the removal of NE connections if end-to-end connections cannot be completed. It supports notification of changes that result from differences between assigned and installed NE configurations.

16) [M] The Manager shall be able to request the Agent to create and delete user ports in order to deactivate service provisioning for ISDN, leased line, and POTS services.

17) [M] The Agent shall report configuration changes to the Manager.

18) [M] The Manager shall register to receive network inventory update notification from the Agent.

19) [M] The Manager shall be able to retrieve the network inventory managed by the Agent.

20) [M] The Manager shall be able to assign user-friendly names to applicable resources.

21) [M] The Manager shall be able to assign the name of the Agent System.

22) [M] The Manager shall set the appropriate filter to receive protection switch notifications.

23) [M] The Manager shall apply protection switch lockout to a reliable resource of a SNC that is protected by SNCP.

24) [M] The usage of network resources shall be monitored by the Manager. This function shall provide the information listed below to assist with network planning:

- the network equipment that is in use;
- the network equipment that is spare;
- the network equipment that is faulty;
- the amount of bandwidth that is in use for permanently configured paths;
- the amount of bandwidth that is spare for permanently configured paths;
- the location of network equipment;
- the types of service that can be supported by the spare bandwidth.

7.3.2 Fault management

The following functions are required for fault management:

1) [M] The Manager shall retrieve a list of active alarms from the Agent, related to network elements managed by the Agent.

2) [M] The alarm report shall include the probable cause, severity, time and location of fault condition detected by the network for all the replaceable equipments.

3) [M] The Agent shall be capable of reporting the following categories of faults to the Manager:

- faults on the network equipment;
- faults on interfaces;
- environmental conditions within the network element where applicable.

4) [M] The Manager shall request a list of alarms, based on specific criteria.

5) [M] The Manager shall be able to set (or change) the criteria for retrieving the list of alarms.

6) [M] The Manager shall correlate faults from a number of Agent domains to determine the actual cause and location of a network problem.

7) [M] The Manager shall be able to set and modify service-specific failure thresholds in an Agent.

8) [M] When the threshold is exceeded an alarm shall be reported to the Manager by the Agent.

9) [M] It shall be possible for a Manager to allow/inhibit alarm reports from an Agent.

10) [M] The Manager shall be able to request the Agent to suppress events which only occur on a rare and intermittent basis which are not of consequence to the network services.

11) [M] The Manager shall be able to request the Agent to suppress all events which are implied by root cause event, but enhance information in root cause event.

12) [M] The Manager shall be able to request the Agent to evaluate the significance of event based on one or more other events which are generated and delivered independently.

13) [M] The Manager shall be able to request the Agent to correlate events based on environmental conditions such as business rules, time of day, configuration values, affecting event significance.

14) [M] The Manager shall be able to request the Agent to correlate events based on information stored externally.

15) [M] The Manager shall be able to request the Agent to initiate an action to be taken based on event information.

16) [M] The Manager shall be able to request the Agent to wait for the receipt of an event, and in turn initiates an action based on the non-arrival of the event within a specified period of time.

17) [M] The Agent shall report to the Manager that it has switched a specified line, service, system or equipment as part of its protection procedures. Such procedures may or may not have been initiated by the Manager.

18) [M] The Manager shall be able to receive MSP and SNCP protection switch notifications when a network fault has occurred or a user triggers a switch from the EMS.

7.3.3 Performance management

The following functions are required for performance management:

1) [M] The Manager shall be able to request the Agent to send current PM data. The Agent sends performance data that may be generated routinely by the Agent, or sent upon demand by the Manager or by exception when a parameter threshold has been exceeded.

2) [M] The Manager shall be able to direct the Agent to start/stop the collection of PM data.

3) [M] The Manager shall be able to direct the Agent to reset storage registers for PM data.

4) [M] The Agent shall support the reporting of the root cause of PM threshold crossing alerts and other PM events, as inferred by an event correlation process that uses knowledge of the topology and states of a network and its component NEs, to facilitate network alarm analysis. It provides access to information concerning identified root causes. It also generates non-redundant notifications of trails that are found to generate persistent threshold crossing alerts.

5) [M] The Manager shall be able to direct the Agent to establish a schedule for the reporting of PM data.

6) [M] The Manager shall be able to retrieve the current PM data reporting schedule. The Agent shall respond with the schedule.

7) [M] The Manager shall be able to request the Agent to send current PM attributes values.

8) [M] The Manager shall be able to direct the Agent to set or change the PM parameter threshold value.

9) [M] The Manager shall be able to instruct the Agent to suspend/resume the PM data collection activity for a given monitored entity or set of monitored entities.

10) [M] The Manager shall be able to instruct the Agent to originate historical data based on some screening criteria (e.g., suppress "all-zero" data).

11) [M] The Manager shall be able to instruct the Agent about the duration of the PM data collection interval for a given entity or set of entities.

12) [M] The Manager shall be able to direct the Agent to send the current PM threshold.

13) [M] The Agent shall support the generation of reports to characterize end-to-end performance of dedicated digital networks, which includes Network Interface-to-Network Interface, and Network Interface-to-Inter-Network Interface (point of termination), in relation to long-term (i.e., 30 or more days) accuracy and availability objectives.

14) [M] The Manager shall be able to request the Agent for the storage capacity (how long the collected data is retained) of the collected PM data.

15) [M] The Manager shall be able to retrieve the PM parameters and location being collected for a managed entity supporting the access network.

16) [M] The Manager shall be able to set or modify the PM threshold values for the termination points (change TPs to monitoring points specified by Manager).

7.4 Element management level for NMS-EMS interface requirements

This clause contains functions that are a subset of those at the network element level, and specifically highlights functions performed by the EMS for possible communication to the NMS. For management exchange between EMS and NMS, some of the functions should be made visible from the element level functions. Consequently several functions from 7.2 (Element management level requirements) may co-exist in this clause as well.

7.4.1 Configuration management

The following functions are required for configuration management:

1) [M] The Agent provides the Manager with capabilities for backing up and restoring of an SDH and DLC system in the case of catastrophic failure of the network element.

2) [M] The Agent tracks the version and update status of SDH-DLC NE software and records this information in a repository accessible by the Manager. The Software Version Control validates the to-be-downloaded software version against the saved version number, and raises exception for invalid to-be-downloaded software version. The Manager shall be able to view the software version information in the repository.

3) [M] The Agent is responsible for providing synchronization and consistency between all physical and logical resource data of the SDH-DLC network.

4) [M] The Manager shall be able to retrieve all protection groups information and protection switch data that exist in the network element from the Agent.

7.4.2 Fault management

The following functions are required for fault management:

1) [M] The Agent shall accept and act on requests to permit/inhibit fault reports from the Manager.

2) [M] Detection of a fault, through network surveillance or network testing, which is affecting service, shall cause the related equipment to be placed in an unavailable state for provisioning purposes.

3) [M] The Agent shall allow a user or Manager to acknowledge and mark outstanding faults as cleared when this is not performed automatically.

4) [M] Where there is an occurrence of a large number of faults, the Agent shall analyse and correlate the faults within its domain to determine the underlying cause of the problem. This should result in the escalation of one fault report with an appropriate repair action to a user or Manager.

5) [M] The Agent is required to use all available information (such as known network element faults and performance data) to support proactive fault location and hence reduce the need for the use of test functions.

6) [M] It shall be possible to set and modify service-specific failure thresholds. A fault shall be reported to the specified users or Manager when a threshold is exceeded.

7) [M] The Agent shall provide surveillance and testing functions on NEs in order to support network maintenance for reporting to the Manager.

8) [M] The Agent shall send the results of diagnostics tests to the Manager.

9) [M] It shall be possible to block and unblock resources that provide service to allow equipment to be maintained. Whilst a resource is blocked for maintenance purposes, it shall not be possible to use the service supported by that resource.

10) [M] It shall be possible to invoke self-tests on specific network equipment from the Agent when requested by the Manager.

11) [M] It shall be possible to verify the correct configuration of a service by requesting a connection test from the Agent to the NEs.

12) [M] It shall be possible to apply test loops to the NE manually on a demand basis during fault diagnosis or automatically as part of background test routines to aid proactive fault location. It shall be possible to activate/deactivate a bit error rate test source in the NEs to check for errors on the path between the loops. The Agent shall also perform this function when directed by the Manager.

7.4.3 Performance management

The following functions are required for performance management:

1) [M] It shall be possible to activate and deactivate the performance monitoring functions from the Agent when requested by the Manager. When a monitoring function is activated, it shall be possible to specify a time period over which performance information is to be recorded. The time period shall be configurable.

2) [M] The Agent shall provide for the activation and deactivation of performance data collection on individual termination points contained in the SDH-DLC NEs as required by the Manager. This function also includes the setting of threshold values and describes automatic reporting of performance measurements when thresholds have been crossed.

3) [M] The Agent processes event notifications from the SDH-DLC NEs within its management jurisdiction. The Agent then identifies the event type and source, transforms and augments the data into an event record structure of potential benefit to upstream systems and users, and transfers the record into an internal repository accessible to the Manager.

4) [M] The Agent shall provide performance data on demand via the user interface or shall generate performance reports periodically according to a pre-established schedule.

Appendix I

Candidate of managed entities

Introduction

This appendix contains an initial list of managed entities and properties. Future Recommendations following the methodology in ITU-T Rec. M.3020 will develop the use cases and analysis to identify the object classes, attributes and operations. Most of the managed entities are taken from existing Recommendations where information models have been defined for management at the NE level, network level or in general support of management. The entities at the network element level correspond to the resources that are made visible to the network management system, also

referred to as combined view in ITU-T Rec. Q.834.1[1]. In the next stage of the Recommendations where UML use case scenarios and classes are defined, where appropriate these entities will be referenced. However, the classes to be defined to meet the use case scenarios in support of these atomic functions are not the same as these managed entities. In this appendix when entities defined in existing Recommendations are referenced, the details are not provided. For new entities, attributes, relationships are included.

I.1 Network element managed entities

The following candidate of managed entities are required in the Network Element Level:

1) Managed Element (ITU-T Rec. M.3100)
2) Software (ITU-T Rec. M.3100)
3) Equipment (ITU-T Rec. M.3100)
4) EquipmentHolder (ITU-T Rec. M.3100)
5) Circuit Pack (ITU-T Rec. M.3100)
6) Alarm Record (ITU-T Rec. M.3100)
7) Alarm Severity Assignment Profile (ITU-T Rec. M.3100)
8) Attribute Value Change Record (ITU-T Rec. M.3100)
9) Management Operations Schedule (ITU-T Rec. M.3100)
10) Object Creation Record (ITU-T Rec. M.3100)
11) Object Deletion Record (ITU-T Rec. M.3100)
12) State Change Record (ITU-T Rec. M.3100)
13) Cross Connection (ITU-T Rec. M.3100)
14) Termination Point (ITU-T Rec. M.3100)
15) Connection Termination Point (ITU-T Rec. M.3100)
16) Administrative Unit 3 (ITU-T Rec. G.774)
17) Administrative Unit 4 (ITU-T Rec. G.774)
18) Administrative Unit Group (ITU-T Rec. G.774)
19) Electrical SPI trail termination point (ITU-T Rec. G.774)
20) Indirect Adaptor (ITU-T Rec. G.774)
21) Multiplex Section Connection Termination Point (ITU-T Rec. G.774)
22) Multiplex Section Data Communications Channel (ITU-T Rec. G.774)
23) Multiplex Section Orderwire (ITU-T Rec. G.774)
24) Multiplex Section Trail Termination Point (ITU-T Rec. G.774)
25) Optical SDH Physical Interface Trail Termination Point (ITU-T Rec. G.774)
26) Regenerator Section Connection Termination Point (ITU-T Rec. G.774)
27) Regenerator Section Data Communications Channel (ITU-T Rec. G.774)

[1] ITU-T Recs Q.834.1 and Q.834.2 are being combined to produce revised ITU-T Rec. Q.834.1.

28) Regenerator Section Orderwire (ITU-T Rec. G.774)
29) Regenerator Section Trail Termination Point (ITU-T Rec. G.774)
30) Regenerator Section User Channel (ITU-T Rec. G.774)
31) SDH Network Element (ITU-T Rec. G.774)
32) Tributary Unit 11 (ITU-T Rec. G.774)
33) Tributary Unit 12 (ITU-T Rec. G.774)
34) Tributary Unit 2 (ITU-T Rec. G.774)
35) Tributary Unit 3 (ITU-T Rec. G.774)
36) Tributary Unit Group 2 (ITU-T Rec. G.774)
37) Tributary Unit Group 3 (ITU-T Rec. G.774)
38) Virtual Container 11 (ITU-T Rec. G.774)
39) Virtual Container 12 (ITU-T Rec. G.774)
40) Virtual Container 2 (ITU-T Rec. G.774)
41) Virtual Container 3 (ITU-T Rec. G.774)
42) Virtual Container 4 (ITU-T Rec. G.774)
43) VC-n User Channel Object Classes (ITU-T Rec. G.774)
44) E1CTPSinkR1 (ETSI EN 300 371 V1.3.2)
45) E1CTPSourceR1 (ETSI EN 300 371 V1.3.2)
46) E1TTPSinkR1 (ETSI EN 300 371 V1.3.2)
47) E1TTPSourceR1 (ETSI EN 300 371 V1.3.2)
48) E3CTPSinkR1 (ETSI EN 300 371 V1.3.2)
49) E3CTPSource (ETSI EN 300 371 V1.3.2)
50) E3TTPSinkR1 (ETSI EN 300 371 V1.3.2)
51) E3TTPSource (ETSI EN 300 371 V1.3.2)

I.2 Network level managed entities

The following candidate of managed entities are required in the Network Level Management:

52) AccessGroup (ITU-T Rec. M.3100 Amendment 1)
53) LayerNetworkDomain (ITU-T Rec. M.3100 Amendment 1)
54) LinkConnection (ITU-T Rec. M.3100 Amendment 1)
55) LogicalLinkEnd (ITU-T Rec. M.3100 Amendment 1)
56) LogicalLink (ITU-T Rec. M.3100 Amendment 1)
57) Network (ITU-T Rec. M.3100)
58) NetworkCTP (ITU-T Rec. M.3100 Amendment 1)
59) NetworkTTP (ITU-T Rec. M.3100 Amendment 1)
60) Subnetwork (ITU-T Rec. M.3100 Amendment 1)
61) SubnetworkConnection (ITU-T Rec. M.3100 Amendment 1)

62) TopologicalLink (ITU-T Rec. M.3100 Amendment 1)

63) TopologicalLinkEnd (ITU-T Rec. M.3100 Amendment 1)

64) Trail (ITU-T Rec. M.3100 Amendment 1)

Appendix II

Table of managed entities

Tables II.1 and II.2 describe the candidate of managed entities and the references either for Network and Network Element Level.

Table II.1/Q.837.1 – Usage of managed entities name (NE view)

Managed entity name	References in other ITU-T Recommendations	References other than ITU-T Recommendations
Managed Element	M.3100	
Software	M.3100	
Equipment	M.3100	
EquipmentHolder	M.3100	
Circuit Pack	M.3100	
Alarm Record	M.3100	
Alarm Severity Assignment Profile	M.3100	
Attribute Value Change Record	M.3100	
Management Operations Schedule	M.3100	
Object Creation Record	M.3100	
Object Deletion Record	M.3100	
State Change Record	M.3100	
Cross Connection	M.3100	
Termination Point	M.3100	
Connection Termination Point (CTP)	M.3100	
E1CTPSinkR1		ETSI EN 300 371 V1.3.2
E1CTPSourceR1		ETSI EN 300 371 V1.3.2
E1CTPBidirectionalR1		ETSI EN 300 371 V1.3.2
E1TTPSinkR1		ETSI EN 300 371 V1.3.2
E1TTPSourceR1		ETSI EN 300 371 V1.3.2
E1TTPBidirectionalR1		ETSI EN 300 371 V1.3.2
E3CTPSinkR1		ETSI EN 300 371 V1.3.2
E3CTPSource		ETSI EN 300 371 V1.3.2
E3CTPBidirectionalR1		ETSI EN 300 371 V1.3.2
E3TTPSinkR1		ETSI EN 300 371 V1.3.2
E3TTPSource		ETSI EN 300 371 V1.3.2

Table II.1/Q.837.1 – Usage of managed entities name (NE view)

Managed entity name	References in other ITU-T Recommendations	References other than ITU-T Recommendations
E3TTPBidirectionalR1		ETSI EN 300 371 V1.3.2
Administrative Unit 3	G.774	
Administrative Unit 4	G.774	
Administrative Group	G.774	
Electrical SPI Trail Termination Point	G.774	
Indirect Adaptor	G.774	
Multiplex Section Connection Termination Point	G.774	
Multiplex Section Data Communications Channel	G.774	
Multiplex Section Orderwire	G.774	
Multiplex Section Trail Termination Point	G.774	
Optical SDH Physical Interface Trail	G.774	
Regenerator Section Connection Termination Point	G.774	
Regenerator Section Data Communications Channel	G.774	
Regenerator Section Orderwire	G.774	
Regenerator Section Trail Terminator	G.774	
Regenerator Section User Channel	G.774	
SDH Network Element	G.774	
Tributary Unit 11	G.774	
Tributary Unit 12	G.774	
Tributary Unit 2	G.774	
Tributary Unit 3	G.774	
Tributary Unit Group 2	G.774	
Tributary Unit Group 3	G.774	
Virtual Container 11	G.774	
Virtual Container 12	G.774	
Virtual Container 2	G.774	
Virtual Container 3	G.774	
Virtual Container 4	G.774	
VC-n User Channel Object Classes	G.774	

Table II.2/Q.837.1 – Usage of managed entities name (NW view)

Managed entities name	References in other ITU-T Recommendations	References other than ITU-T Recommendations
AccessGroup	M.3100 Amendment 1	
LayerNetworkDomain	M.3100 Amendment 1	
LinkConnection	M.3100 Amendment 1	
LogicalLinkEnd	M.3100 Amendment 1	
LogicalLink	M.3100 Amendment 1	
networkR1	M.3100	
NetworkCTP	M.3100 Amendment 1	
NetworkTTP	M.3100 Amendment 1	
Subnetwork	M.3100 Amendment 1	
SubnetworkConnection	M.3100 Amendment 1	
TopologicalLink	M.3100 Amendment 1	
TopologicalLinkEnd	M.3100 Amendment 1	
TrailR2	M.3100 Amendment 1	

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series B	Means of expression: definitions, symbols, classification
Series C	General telecommunication statistics
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	Transmission systems and media, digital systems and networks
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	Cable networks and transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	Construction, installation and protection of cables and other elements of outside plant
Series M	TMN and network maintenance: international transmission systems, telephone circuits, telegraphy, facsimile and leased circuits
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Telephone transmission quality, telephone installations, local line networks
Series Q	**Switching and signalling**
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks and open system communications
Series Y	Global information infrastructure, Internet protocol aspects and Next Generation Networks
Series Z	Languages and general software aspects for telecommunication systems

Printed in Switzerland
Geneva, 2004