INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

X.161

(08/97)

SERIES X: DATA NETWORKS AND OPEN SYSTEM COMMUNICATION

Public data networks – Maintenance

Definition of customer network management services for public data networks

ITU-T Recommendation X.161

(Previously CCITT Recommendation)

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ITU-T RECOMMENDATION X.161

DEFINITION OF CUSTOMER NETWORK MANAGEMENT SERVICES FOR PUBLIC DATA NETWORKS

Summary

This Recommendation defines the management services which may be provided to a customer and collectively described as Customer Network Management (CNM). CNM is a service which provides customers with the ability to access (and in some cases modify) management information relating to the services provided to them by the network.

Source

ITU-T Recommendation X.161 was revised by ITU-T Study Group 7 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 9th of August 1997.

FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. The 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 Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 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.

INTELLECTUAL PROPERTY RIGHTS

The ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. The 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, the 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.

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Recommendation X.161

DEFINITION OF CUSTOMER NETWORK MANAGEMENT SERVICES FOR PUBLIC DATA NETWORKS

(revised in 1997)

1 Scope

This Recommendation defines the management services and supporting functions for CNM. Where possible, reference is made to other Recommendations which define management services and functions. This Recommendation is intended to complement TMN specifications and provide a specification for the non-TMN environment. The relationship of this Recommendation to other Recommendations for CNM is presented in Recommendation X.160. Definitions of management information for the currently defined CNM interfaces are in Recommendations X.162 and X.163.

This Recommendation is applicable to provision of the CNM Service in the Public Data Network (PDN) environment. In future, this may extend to other network technologies. The specification contained in this Recommendation is written such that it may be developed to be generic to all network technologies where the requirement for CNM is identified.

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; all 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.

2.1 Identical Recommendations | International Standards

– ITU-T Recommendation X.701 (1997) | ISO/IEC 10040:1997, *Information technology – Open Systems Interconnection – Systems management overview.*

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

– CCITT Recommendation X.730 (1992) | ISO/IEC 10164-1:1993, *Information technology – Open Systems Interconnection – Systems Management: Object management function.*

– CCITT Recommendation X.731 (1992) | ISO/IEC 10164-2:1992, *Information technology – Open Systems Interconnection – Systems Management: State Management Function.*

– CCITT Recommendation X.733 (1992) | ISO/IEC 10164-4:1992, *Information technology – Open Systems Interconnection – Systems Management: Alarm reporting function.*

– CCITT Recommendation X.734 (1992) | ISO/IEC 10164-5:1993, *Information technology – Open Systems Interconnection – Systems Management: Event report management function.*

– CCITT Recommendation X.735 (1992) | ISO/IEC 10164-6:1993, *Information technology – Open Systems Interconnection – Systems Management: Log control function.*

2.2 Paired Recommendations | International Standards equivalent in technical content

– CCITT Recommendation X.710 (1991), *Common management information service definition for CCITT applications.*

ISO/IEC 9595:1991, *Information technology – Open Systems Interconnection – Common management information service definition.*

– CCITT Recommendation X.711 (1991), *Common management information protocol specification for CCITT applications.*

ISO/IEC 9596-1:1991, *Information technology – Open Systems Interconnection – Common management information protocol – Part 1: Specification.*

2.3 Additional references

– ITU-T Recommendation F.400/X.400 (1996) – *Message handling system and service overview.*

– CCITT Recommendation M.3010 (1992), *Principles for a telecommunications management network.*

– ITU-T Recommendation M.3020 (1995), *TMN interface specification methodology.*

– ITU-T Recommendation Q.821 (1993), *Stage 2 and stage 3 description of the Q3 interface – Alarm surveillance.*

– ITU-T Recommendation Q.822 (1994), *Stage 1, stage 2 and stage 3 description of the Q3 interface – Performance management.*

– ITU-T Recommendation X.160 (1996), *Architecture for customer network management service for public data networks.*

– ITU-T Recommendation X.162 (1997), *Definition of management information for customer network management service for public data network to be used with the CNMc interface.*

– ITU-T Recommendation X.163 (1995), *Definition of management information for customer network management service for public data network to be used with the CNMe interface.*

– ITU-T Recommendation X.411 (1995), *Information Technology – Message Handling Systems (MHS): Message transfer system – Abstract service definition and procedures.*

– ITU-T Recommendation X.790 (1995), *Trouble management function, for ITU-T applications.*

3 Definitions

This Recommendation makes use of the following terms defined in Recommendation X.160:

– CNMc;

– CNMe;

– Customer's Management System;

– Service Provider's CNM System.

This Recommendation makes use of the following terms defined in Recommendation M.3020:

– TMN Management Function (or function);

– TMN Management Function Set.

4 Abbreviations

This Recommendation uses the following abbreviations:

CMIS	Common Management Information Service
CNM	Customer Network Management
CNMc	Customer Network Management using CMIP
CNMe	Customer Network Management using EDI/MHS
EDI	Electronic Data Interchange
EFD	Event Forwarding Discriminator
FU	Functional Unit
ISP	International Standardised Profile
MAPDU	Management Application Protocol Data Unit

MHS Message Handling System

MIB Management Information Base

OSI Open Systems Interconnection

PDN Public Data Network

TMN Telecommunications Management Network

5 Conventions

The following conventions apply to the tables contained in this Recommendation.

M Mandatory

O Optional

– Not defined

N/A Not Applicable

FS Further Study

C Conditional

6 Overview of Customer Network Management services

A CNM service is a capability that is provided to a customer across a CNM interface. A CNM service is provided for example by using CMIS, OSI Systems Management Functions and appropriate management information. Alternatively, a CNM service can be provided by exchanging EDI forms over MHS.

The services currently defined in this Recommendation (and summarised in Annex A) are those services which are considered to be of most importance to customers, and are therefore priorities for provision. Further services are identified but are considered to be of lower priority. Other CNM services may be added in future when further OSI System Management Functions have been completed and additional business requirements have been identified.

The CNM services defined in this Recommendation are, for convenience, classified into six groups:

– Fault Management;

– Accounting Management;

– Configuration Management;

– Performance Management;

– Security Management;

– CNM supporting services.

This Recommendation should be read in conjunction with Recommendation X.160, which defines the CNM Architecture, and Recommendations X.162 and X.163, which define management information for CNMc and CNMe interfaces, respectively.

7 CNM services definitions

The following clauses describe the CNM services that may be provided across the CNM interfaces.

When the service is provided across the CNM interface, the description is made in accordance with the TMN interface specification methodology defined in Recommendation M.3020. In the case of the CNMc interface, the term "CNM service" is fully equivalent to the term "TMN Management function set" and the associated management information is defined in Recommendation X.162. When the service is provided across the CNMe interface, the description is made using EDI forms. These forms are defined in Recommendation X.163.

Elements of procedure to be used for provision of CNM services are described in Recommendation X.162 for the CNMc interface.

7.1 Fault Management

7.1.1 CNM Alarm Notification Service

7.1.1.1 Service definition

The CNM Alarm Notification Service provides a customer with the capability to be notified when a failure or event occurs which affects the normal operation of the customer's dedicated resources. It may also apply to shared resources that are used by the customer.

7.1.1.2 Functional description

The following functions are associated with the alarm notification service; some of them are optional, as shown in Table 1:

a) *Report alarm function*

This function sends a customer alarms related to him. Alarms may include communication faults, degradation of QOS, processing error of the network, equipment faults and abnormality of communication environment.

b) *Report state change function*

This function sends a customer event reports related to state change of his own resource or shared resources he uses.

c) *Inhibit/Allow alarm and state change reporting function*

This function controls the suspension and resumption of alarm reporting by the customer request.

d) *Condition alarm and state change reporting function*

This function allows to modify criteria for reporting events (alarms or state change reports). Criteria may include the time of events, the type of events, the resource name from which alarms are emitted, the type of problem or cause, and severity of the fault.

e) *Retrieve alarm and state change reporting conditions function*

This function allows the Customer's Management System to request the Service Provider's CNM System to send the current assignment of the filtering criteria it specifies.

Table 1/X.161 – CNM alarm notification services

Functions	Support	Purposes
Report alarm	M	Alarm reporting
Report state change	O	State change reporting
Inhibit/Allow alarm and state change reporting	O	Alarm and state change reporting suspension/resumption
Condition alarm and state change reporting	O	Alarm and state change reporting control
Retrieve alarm and state change reporting conditions	O	Alarm and state change reporting condition retrieval

7.1.2 CNM Fault History Service

7.1.2.1 Service definition

The CNM Fault History Service provides a customer with the capability to retrieve its own fault history log records stored at the service provider side. The report contains information related to failure or event occurrence which affect the normal operation of the customer's dedicated resources.

This service may be used, for example for particular events with low severity which have been recorded or logged within the fault history log but which have not been sent to the customer.

It may also be used to provide periodically fault histories to the customer.

7.1.2.2 Functional description

The following functions are associated with the CNM Fault History Service. Some of them are optional, as shown in Table 2:

a) Retrieve fault history log records function: This function accumulates alarms related to a customer in the forms of a fault log record. Log records include communications faults, degradation of QOS, processing error of the network, equipment faults, abnormality of communication environment, creation/deletion of the customer's dedicated resources and change of their states. These records are accessed by the customer.

b) Select specific fault log records function: This function selects specific fault log records based on requested filtering condition.

c) Modify the criteria for logging fault log records function: This function modifies criteria for logging fault log records.

Table 2/X.161 – CNM Fault History Service

Function	Support	Purposes
Retrieve fault history log records	M	Fault log retrieval
Select specific fault log records	O	Fault log selective retrieval
Modify the criteria for logging fault log records	O	Fault log logging criteria change

7.1.3 CNM Trouble Report Service

7.1.3.1 Service definition

The Trouble Report Service is called the automated trouble ticketing function. This service provides a customer with the capability to report trouble on services or resources that affect the customer's communication, track the progress of trouble to its resolution, and identify the clearing and closure of trouble.

When a customer finds the occurrence of trouble in his communication, he informs about the perceived trouble by issuing a Telecommunication Trouble Report containing information about the trouble. The customer can retrieve the format provided by the service provider by electrical access. Several formats may be defined using standard attributes. Repair activities can be retrieved from historical records of activities performed to resolve the trouble, such as activity information and activity person.

When the network (the service provider) finds the occurrence of trouble in a customer's communication, the provider creates a Telecommunication Trouble Report and notifies the customer of the trouble.

Also, this function allows the service provider to report the trouble report progress information to the customer, or log the information at the service provider side.

Through this service, a customer is also given information about a plan or schedule for maintenance action which affects the customer's communication.

A customer may also retrieve past trouble reports that have been reported.

7.1.3.2 Functional description

The following functions are associated with the Trouble Report Service. Some of them are optional, as shown in Table 3:

a) *Control Basic Trouble Report function*

This function controls basic trouble report handling.

Capabilities include:

– giving notice to the customer/service provider that a service provided by the network is in need of repair;

– allowing the customer to ask for status information on a previously entered trouble report;

- providing a template for a trouble report for a particular service or class of services (to show what attributes of a trouble report are considered mandatory or optional);
- notifying the customer that the trouble report has been closed out, or keeps the closed-out information in an internal log;
- allowing the customer to ask for information about past troubles that have been reported;
- adding information to a trouble report that it has entered;
- notifying the customer that the status of that trouble report has changed;
- notifying the customer that the commitment time for that trouble report has changed;
- notifying the customer that other attributes of interest for that trouble report have changed;
- notifying the customer that a trouble report has been created, either as the result of a request or as a result of an internal action of the service provider;
- notifying the customer that a trouble report has been deleted, either as the result of a request or as a result of an internal action of the service provider;
- notifying the customer on a periodic basis about the status of any trouble that has occurred during a defined period (this would be by prior agreement between the service provider and the customer);
- allowing the customer to verify that the repair has been completed to its satisfaction before the trouble report is closed out in the service provider (network);
- notifying the customer that a Trouble Report Format Definition has been created;
- notifying the customer that a Trouble Report Format Definition has been deleted;
- notifying the customer that a Trouble Report Format Definition attribute of interest has changed;
- notifying the customer about progress on resolving the trouble;
- allowing the customer to notify that a previously reported trouble is no longer of interest;
- providing information that may be used for trouble report correlation;
- notifying a customer of a plan or schedule for maintenance action which affects the customer's communication such as file update, a kind of test.

b) *Report maintenance plan*

This function notifies the customer that planned maintenance or preventive maintenance action is scheduled, to prevent future trouble.

c) *Report Trouble History function*

This function allows the Service provider to report the trouble report close out information to the customer.

Table 3/X.161 – CNM Trouble Report Service

Functions	Support	Purposes
Control Basic Trouble Report	M	Basic Trouble Report handling
Report maintenance plan	O	Planned maintenance information notification
Retrieve Trouble History	O	Trouble History retrieval

7.1.4 CNM Loop Set-up Service

7.1.4.1 Service definition

The Loop Set-up Service provides a customer with the capability to set a loop-back point in the network, e.g., local or remote subscriber line for the purpose of loop-back test performed by the customer himself.

7.1.4.2 Functional description

The following functions are associated with the Loop Set-up Service. Some of them are optional, as shown in Table 4:

– *Set/reset loop-back point function*

This function controls the set and reset of a loop-back point. The position of the loop-back point can be specified. A loop-back point can be set at the remote end of the customer's subscriber line or at either end of the remote DCE/DTE interface.

NOTE 1 – The service provider only sets a loop-back point, and the customer DTE itself executes tests by sending and receiving test signals. Any kind of test that uses loop-back point may be performed, e.g. a loop-back test or echo test.

NOTE 2 – The loop-back point at the remote end DTE can be set if the service provider's network has a remote loop set mechanism.

Table 4/X.161 – CNM loop set-up service

Functions	Support	Purposes
Set/reset loop-back point	M	Loop-back point activation/deactivation

7.1.5 CNM Test Host Service

7.1.5.1 Service definition

The Test Host Service provides a customer with the capability to get information on results from a test performed by the service provider instead of by the customer. The service provider may perform several kinds of test, e.g., loop-back test and protocol integrity test. After the execution of the test, the customer may retrieve result information stored in a log record, or be notified by a report.

7.1.5.2 Functional description

Test host refers to the ability of the service provider to execute testing instead of a customer. Test results are retrieved by a customer or notified by a report. The following specified functions are associated with the control activity; some of them are optional, as shown in Table 5.

a) *Execute loop-back test function*

This function controls the execution of the loop-back test. The service provider sends a test pattern to the loop-back point previously set by the customer at the customer's premises. Echoed test patterns are analysed in the service provider and an error ratio and error reasons are returned as test results. The loop-back test can be terminated, or suspended/resumed, on customer request. Test results can be discriminated in accordance with the customer's criteria and can be logged. Test start and duration time can be designated.

b) *Execute protocol integrity test function*

This function controls the execution of a protocol integrity test. The service provider checks the customer's responses to a sequence of protocol elements generated by the service provider. The customer only has to exhibit normal behaviour in response to the protocol elements received. The outcome (pass, fail), and error reasons are notified or logged. This test may be terminated, or suspended/resumed, on customer request. Test results can be discriminated in accordance with the customer's criteria. Test start and duration time can be designated.

Table 5/X.161 – CNM Test host service

Functions	Support	Purposes
Execute loop back test	C1	Loop back test control
Execute protocol integrity test	C1	Protocol integrity test control
C1 At least one of these functions shall be provided if the CNM Test Host Service is supported.		

7.1.6 CNM Protocol Monitoring Service

This CNM service is for further study.

7.2 Configuration Management

7.2.1 CNM Configuration Inquiry Service

7.2.1.1 Service definition

The CNM Configuration Inquiry Service provides a customer with the capability to acquire and maintain information about the telecommunications services and equipment supplied by the service provider. Capabilities include:

– tracking network services and equipment supplied by the service provider, allowing the customer to identify the location, and responsible person(s);

– attachment of customer organisational information to services and equipment;

– contract number;

– telephone number;

– facsimile number;

– contact details;

– contact procedure;

– auditing and queries of service provider's data to rectify perceived errors.

7.2.1.2 Functional description.

The following functions are associated with the Configuration Inquiry Service; some of them are optional, as shown in Table 6:

a) *Retrieve full configuration information function*

The Customer's Management System acquires all the information needed for having a complete view of the network services that are managed.

b) *Retrieve partial configuration information function*

The Customer's Management System selectively acquires (a) part(s) of the configuration information.

c) *Update configuration update function*

The Service Provider's CNM System automatically informs the Customer's Management System of a spontaneous change in the configuration.

Table 6/X.161 – CNM Configuration Inquiry Service

Functions	Support	Purpose
Retrieve full configuration information	M	Complete configuration acquisition
Retrieve partial configuration information	O	Partial configuration acquisition
Update configuration information	O	Automatic configuration update

7.2.2 CNM Reconfiguration Service

7.2.2.1 Service definition

The CNM Reconfiguration Service provides a customer with the capability to modify parameters associated with configurable aspects of their network services. Reconfiguration may take effect immediately as a result of direct action by the customer or on a delayed basis as a result of actions by the service provider. In both cases, security mechanisms may be implemented by the service provider.

7.2.2.2 Functional description

The following functions are associated with the reconfiguration service. Some of them are optional, as shown in Table 7.

a) *Control immediate reconfiguration function*

This function allows the customer to directly and immediately modify the configuration of the customer resources. The customer resources that can actually be modified will be defined by the service provider.

b) *Control delayed reconfiguration function*

This function modifies the configuration of the customer resources or service profiles on a delayed basis. Modification may be negotiated between the service provider and a customer. For this purpose, the CNM Service Request Service defined in this Recommendation is used.

Table 7/X.161 – CNM Service Reconfiguration Service

Function	Support	Purposes
Control immediate reconfiguration	C2	Configuration setting
Control delayed reconfiguration	C2	Service request
C2 The control immediate reconfiguration function is mandatory for the CNMc interface. The control delayed reconfiguration function is mandatory for the CNMe interface		

7.2.3 CNM Ordering Service

7.2.3.1 Service definition

CNM Ordering provides a customer with the capability to request and manage orders with the service provider. Capabilities include:

– creating service orders with scheduling requirements;

– receiving provisioning status;

– amending service orders (where appropriate);

– attaching customer reference information; and

– creating, modifying and deleting PVCs.

Ordering may take effect immediately as a result of direct action by the customer or on a delayed basis as a result of actions by the service provider. In both cases, security may be implemented by the service provider.

7.2.3.2 Functional description

In the case of ordering service on a delayed basis, negotiation and validation mechanisms may be implemented by the service provider. These mechanisms may be provided using the CNM Service Request Service defined in this Recommendation.

7.2.4 CNM Cancellation Service

This service allows a customer to cancel a network service he has previously ordered.

The customer may cancel his subscription, for example :

– X.25 Termination Point;

– PVC;

– Closed User Group;

– Hunt Group.

Cancellation may take effect immediately as a result of direct action by the customer or on a delayed basis as a result of actions by the service provider. In both cases, security may be implemented by the service provider.

7.2.4.1 CNM Cancellation Service definition

In the case of cancellation service on a delayed basis, negotiation and validation mechanisms may be implemented by the service provider. These mechanisms may be provided across the interface using the CNM Service Request Service defined in this Recommendation.

7.2.5 CNM Systematic Call Redirection Service

7.2.5.1 Service definition

The Systematic Call Redirection Service provides a customer with the capability to start and stop the use of the redirection facility, to modify the criteria and schedule of the facility, and also to add, remove, and change the list by which calls destined to the customer's DTE are redirected to another DTE, as defined Recommendation X.25.

7.2.5.2 Functional description

The following specific functions are associated with control activity. Some of them are optional, as shown in Table 8.

a) *Activate/deactivate call redirection function*

This function controls the execution of systematic call redirection activity. Systematic call redirection is activated or deactivated. Call redirection addresses are set at the time of subscription.

b) *Suspend/resume systematic call redirection function*

This function suspends systematic call redirection activity temporally. Also, the use of call redirection is resumed.

c) *Modify redirected address function*

This function modifies the call redirection list. Each element of this list can be modified. New elements can be added and some existing elements can be removed. Also, the priority (order) of each redirected address can be modified.

d) *Schedule call redirection function*

This function controls the scheduling of systematic call redirection activity. Activity is started at the same time every day (the daily scheduling) or at the designated start time/stop time on a certain day (the duration scheduling).

Table 8/X.161 – CNM Systematic Call Redirection Service

Function	Support	Purposes
Activate/deactivate call redirection	M	Call redirection activation/deactivation
Suspend/resume call redirection	O	Call redirection suspension/resumption
Modify redirected addresses	O	Call redirection list modification
Schedule call redirection	O	Call redirection scheduling

7.2.6 CNM Inventory Inquiry Service

CNM Inventory Inquiry Service provides a customer with the capability to acquire and maintain information about the telecommunications equipment supplied by the service provider. This includes all equipment assigned to the customer whether or not they are operational. For example, this service can provide information about the equipment type, manufacturer, model number, serial number, location, etc.

The details of this CNM service and the management information model are for further study.

7.3 Accounting Management

7.3.1 CNM Periodic Billing Service

7.3.1.1 Service definition

Billing provides a customer with invoicing information, and the functionality to perform analysis, processing and reporting on a range of financial topics. Capabilities may include:

a) periodic billing to allow customers to receive an electronic copy of their invoice;

b) hierarchy management to enable users to create and manage their own organisational structures (unit, project, geographical or financial);

c) customer invoice validation:

   1) invoice query management to identify queried invoice items and report on them;

   2) allocation and apportionment of costs to allow a customer to allocate charges to responsible cost centres, including allocation of discounts;

   3) cost management reports on customer telecommunications expenditure to assist in identifying excessive usage.

The following capabilities are also for further study:

– contract management with automatic notification of approaching critical dates;

– credit management to allow a customer to access information relating to their invoicing points (account balance and payment status), and a log of transactions recorded for their accounts; and

– customer management to allow a customer to inform the service provider of changes to customer information.

This Recommendation provides a basic framework of billing, i.e., the notification of invoices and the control of notification. Since billing is dependent on the policy of network operating companies, billing items are not defined in this Recommendation but by each operating company.

7.3.1.2 Functional description

The following functions are associated with the periodic billing service. Some of them are optional, as shown in Table 9.

a) *Notify invoice function*

   This function sends an invoice periodically or when some events occurs to notify an invoice.

b) *Control invoice notification function*

   This function suspends or resources the notification of invoices.

Table 9/X.161 – CNM Periodic Billing Service

Function	Support	Purposes
Notify invoice	M	Invoice periodic report
Control invoice notification	O	Invoice report control

7.3.2 CNM Detailed Accounting Service

7.3.2.1 Service definition

The Detailed Accounting Service provides a customer with the capability to retrieve his own accounting records. These records are automatically created as a consequence of the occurrence of accountable events in a customer's communication. An accounting record contains information elements and counters that identify the customer, the used resources, the usage time and the usage volume.

NOTE – It can be precise that the service providers will have the possibility to set some control functions like starting, suspending, or resuming the operations of related usage metering data objects or stopping the overall activity. These functions are described in Recommendation X.742: Usage metering function for accounting purposes.

7.3.2.2 Functional description

– *Retrieve accounting records function*

Through this function, a customer may retrieve his accounting records stored in the CNM service provider. He may select records by using the filtering mechanism.

Table 10/X.161 – CNM Detailed Accounting Service

Functions	Support	Purpose
Retrieve accounting records	M	Usage metering record retrieval

7.3.3 CNM Quota Control Service

This CNM service is for further study.

7.3.4 CNM Real-time Charging Information Service

This CNM service is for further study.

7.4 Performance Management

7.4.1 CNM Traffic Information Service

7.4.1.1 Service definition

This service provides a customer with capability to retrieve traffic information (statistical data). He may control how to collect traffic data, as well as specify what traffic item is required. The customer may access only the resources related to his communications. This service shall be provided if and only if the customer registers the use of the service to the service provider.

7.4.1.2 Functional description

The following functions are associated with the traffic information service. Some of them are optional, as shown in Table 11.

Traffic data collection refers to the ability for the service provider to collect the various traffic data relating to a single monitored entity in the network. The following specific functions are associated with the collection activity:

a) *Assign traffic data collection interval function*

This function assigns the duration of the traffic data collection interval for a given entity.

b) *Assign history duration function*

This function assigns the duration during which to maintain a specific record of traffic historical data. The maximum number of records are based on the agreement between the service providers and a customer. The stored data are kept for a certain period agreed by both the service provider and its customer.

c) *Retrieve traffic data function*

Through this function, current or historical traffic data information on a given monitored entity or set of monitored entities is retrieved.

NOTE – Traffic data that may be handled by this service are based on the agreement between the service provider and its customers. Examples are:

– callAttempt;

– callConnected;

– callTimeouts;

– clearTimeouts;

– dataPacketsReceived;

– dataPacketsSent;

– octetsReceivedCounter;

– octetsSentCounter;

– protocolErrorsAccusedOf;

– protocolErrorsDetectedLocally;

– service provider InitiatedDisconnects;

– service provider InitiatedResets;

– resetTimeouts;

– remotelyInitiatedResets;

– remotelyInitiatedRestarts;

– segmentsReceived;

– segmentsSent.

d) *Suspend/resume traffic data collection function*

Through this function, a customer may instruct the service provider to suspend/resume the traffic data collection activity for a given monitored entity;

e) *Schedule traffic data collection function*

This function controls the scheduling the traffic data collection activity for a given entity or set of entities. For the time being, only the daily scheduling by which a customer may collect traffic data at the same hour and minute every day, and the duration scheduling, by which a customer may specify the start time and stop time for traffic data collection, are provided.

f) *Suppress zero function*

This function originates historical data by suppresses all zero data.

Table 11/X.161 – CNM Traffic Information Service

Functions	Support	Services
– Assign collection interval – Assign history duration – Retrieve traffic data	M	Traffic data retrieval
Suspend/resume traffic data collection	O	Traffic data collection suspension/resumption
Schedule traffic data collection	O	Traffic data collection scheduling
Suppress all zero data	O	Zero suppression

7.4.2 CNM Quality of Service Information Service

This CNM service is for further study.

7.4.3 CNM Network Statistics Service

7.4.3.1 Service definition

This service allows the Customer's Management System to receive aggregated information about the traffic inside the customer's network and about the usage of the components of the network.

This information may be used by the Customer's Management System to optimise and manage the usage of a given X.25 interface.

Aggregation of counters is a local matter for each provider.

7.5 Security Management

7.5.1 CNM Password Change Service

This CNM service is for further study.

7.5.2 CNM Access Rights Definition Service

This CNM service is for further study.

7.6 CNM supporting services

7.6.1 CNM Service Request Service

7.6.1.1 Service definition

In the framework of the CNM, customers can directly manipulate resources represented by management information, through interaction between their management systems and the Service Provider's CNM System. In practice, there are numerous cases where the service provider will not let the service customer directly manage some resources. Allowing a customer to manipulate resources can affect security. The operations required for service provision or usage may need human intervention (for example, placing a device for performance measurement, or ordering a new X.25 interface).

Therefore, functionality is needed to allow the customer to request a service provision or usage from the service provider. Functionality to control and monitor this request and to negotiate eventually some of its details is also required by the customer.

7.6.1.2 Functional description

The following functions are associated with the Traffic Information Service. Some of them are optional, as shown in Table 12.

The service request function is associated with the service request service. It allows a Customer's Management System to request a service from the Service Provider's CNM System and provides the ability to:

– create and delete a service request;

– modify elements of the service request;

– be informed of modifications made, by the provider, on the service request;

– obtain all information about the service request processing results;

– propose the date at which the service is to be furnished;

– be informed about the fixed date for the service to be furnished;

– negotiate details of the service request (such as the dates);

– consult a posteriori all the information associated with a deleted service request.

Table 12/X.161 – CNM Service Request Service

Function	Support	Purposes
Service request	M	– initiation of a service request – deletion of a service request – negotiation of a service request – retrieval of a service request

8 Compliance with Recommendation X.161

Recommendations that reference Recommendation X.161 and define CNM interfaces (e.g. X.162 and X.163) shall comply with Recommendation X.161 and shall include a conformance clause. This shall state that if a service defined in this Recommendation or a service set defined in Annex B is implemented, then at least the mandatory parts of those services shall be implemented.

Annex A

Summary of CNM services

Table A.1 summarises for each of the CNM services currently defined in this Recommendation the CNM interface type on which they may be implemented (indicated by the letter X).

Table A.1/X.161 – Summary of CNM services

Group	Service name	CNMc interface	CNMe interface
Fault management	CNM Alarm notification	X	FS
	CNM Fault History	FS	FS
	CNM Trouble Report	X	FS
	CNM Loop set-up	X	FS
	CNM Test Host	X	FS
	CNM Protocol Monitoring	FS	FS
Configuration management	CNM Configuration Inquiry	X	FS
	CNM Reconfiguration (includes Activate/Deactivate)	X	X
	CNM Ordering (includes PVC)	X	X
	CNM Cancellation	X	X
	CNM Systematic Call Redirection	FS	FS
	CNM Inventory Inquiry Service	FS	FS
Accounting	CNM periodic billing	X	X
	CNM Detailed accounting	X	X
	CNM Quota Control	FS	FS
	CNM Real-time Charging Information	FS	FS
Performance management	CNM Traffic information	X	FS
	CNM Quality of service	FS	FS
	CNM Network statistics	FS	FS
Security management	CNM Password Change Service	FS	FS
	CNM Access Rights definition	FS	FS
Supporting services	CNM Service Request	X	X

Annex B

CNM Service sets

To encourage consistency in the provision of CNM services to customers, this annex designates sets of CNM services. While services providers may offer CNM services in any combination, they are encouraged to provide CNM services according to one or more of these sets.

The services included in each set are shown in Table B.1. Compatibility between the service sets offered by the services providers and those that can be used by the customer are shown in Table B.2. Additional CNM services may be offered with any of these sets including CNM services defined in this Recommendation and network-dependent CNM services.

NOTE – The CNM service sets will conform to specific elements of the common part of the functional ISPs. The definition of these conformance aspects is for further study.

Table B.1/X.161 – Definition of the service sets

Sets / Services	Set 1	Set 2	Set 3	Set 4	Set 5	Set 6	Set 7	Set 8	Set 9	Set 10
Alarm Notification	X		X		X		X	X	X	
Configuration inquiry	X	X	X	X	X	X	X	X	X	X
Trouble Report		X		X		X	X	X	X	
Reconfiguration			X	X	X	X		X	X	X
Ordering and cancellation					X	X			X	X

NOTE 1 – Service sets 1 to 10 may be provided over the CNMc interface. Service sets 2, 4, 6 and 10 may be provided over CNMe interface.

NOTE 2 – For configuration inquiry over the CNMe interface, the service sets 2, 4, 6, and 10 will include this service when it is defined in Recommendation X.163.

For Trouble Report over the CNMe interface, the service sets 2, 4 and 6 will include this service when it is defined in Recommendation X.163.

Table B.2/X.161 – Service sets compatibility

Set 1	Set 2	Set 3	Set 4	Set 5	Set 6	Set 7	Set 8	Set 9	Set 10	Service sets provided by the service provider / Service sets usable by the customer
X		X		X		X	X	X		**Set 1**
	X		X		X	X	X	X		**Set 2**
		X		X			X	X		**Set 3**
			X		X		X	X		**Set 4**
				X				X		**Set 5**
					X			X		**Set 6**
						X	X	X		**Set 7**
							X	X		**Set 8**
								X		**Set 9**
				X				X	X	**Set 10**

NOTE – These apply to service sets over the same interface.

Annex C

Typical sequences of CNM services

C.1 Introduction

The CNM Service is divided into six main service groups as follows:

– Fault Management;

– Configuration Management;

– Accounting Information;

– Performance Management;

– Security Management;

– Service Inquiry.

Each of these service groups is divided into specific functions that are themselves provided by elementary services. This Annex gives typical sequences of these elementary services for each function.

C.2 Fault Management

The Fault Management service group is divided into the following functions:

– CNM Alarm Notification;

– CNM Fault History;

– CNM Trouble Report;

– CNM Loop set-up;

– CNM Test host;

– CNM Protocol monitoring.

This service group can also be divided into functions that concern loss of service (e.g. line down), and functions that concern performance trouble (e.g. connect time exceeds agreed level).

C.2.1 CNM Alarm Notification

A fault event can be characterised by the following attributes:

– type of event;

– entity where generated;

– perceived gravity;

– responsibility.

The typical information flows of elementary services are shown in Figure C.1.

A fault event is one that prevents the provision of the expected service. The event, therefore, may be in the customers or the providers network. The usual work flow is notification --> identification --> analysis --> resolution.

C.2.2 CNM Fault history

Fault histories could be provided periodically or on request as shown pictorially in Figures C.2 and C.3.

The fault history request message could include information such as:

– period;

– level of reporting;

– particular fault numbers.

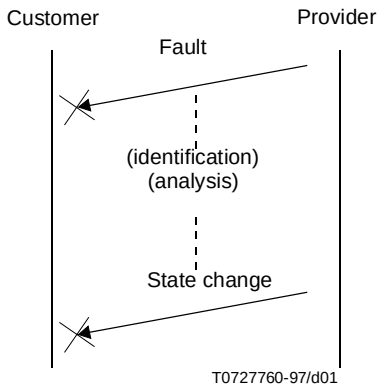

Figure C.1/X.161 – Fault event information flow

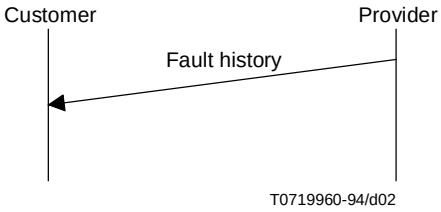

Figure C.2/X.161 – Periodic fault history information flow

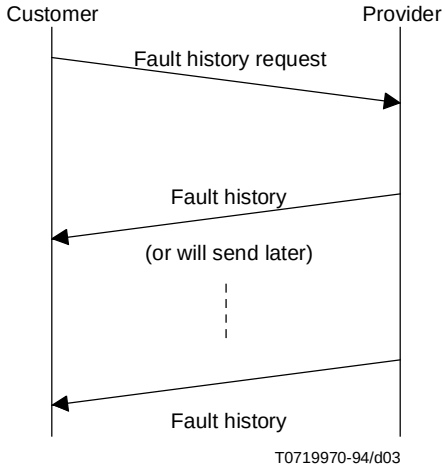

Figure C.3/X.161 – Requested fault history information flow

The fault history report message could include information such as:

– period covered;

– faults or no faults in period.

If there are faults then for each:

– identification of object;

– severity;

– service below agreed level or not;

– duration of fault;

– outstanding or resolved;

– perceived course;

– responsibility;

– date and time of occurrence;

– date and time of resolution – or expected date of resolution;

– status (open, closed, in process).

To this would be added standard information such as Customer identification. Actions taken to resolve the problem could include a visit to the customer site that the customer will be charged for, or is covered in the service agreement.

Summary information could be included which would provided information such as number of faults if each gravity level, total down-time, and so on.

C.2.3 CNM Trouble Report

This function is for further study.

C.2.4 CNM Loop set-up

This function is for further study.

C.2.5 CNM Test host

This function is for further study.

C.2.6 CNM Protocol monitoring

This function is for further study.

C.3 Configuration Management

The Configuration Management service group is divided into the following functions:

– Configuration inquiry:

  Two subsets are planned: full inquiry (all information) and partial. The latter is more difficult as it requires filtering criteria;

– Service Reconfiguration (within the terms of the contract);

– Ordering (change to the terms of the contract;

– Inventory inquiry;

– Systematic call redirection.

These services could cover all sorts of matters such as X.25 line, speech line, window size, packet size, closed user groups and so on.

C.3.1 Configuration inquiry

A configuration inquiry may be for a complete set of information related to a particular customer or for a partial set (according to some selection criteria). It would also be possible to have on automatic configuration update service.

The information flows for these services are likely to be simple request/response pairs as depicted in Figure C.4:

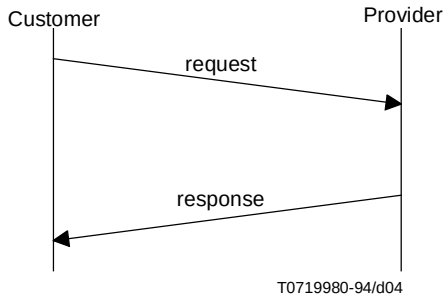

Figure C.4/X.161 – Service inquiry information flow

The situation is complicated by the fact that the customer could be using more than one network as shown in Figure C.5. Thus, there will be a need for an identification scheme for networks, network elements, services, physical items, data rates, and so on.

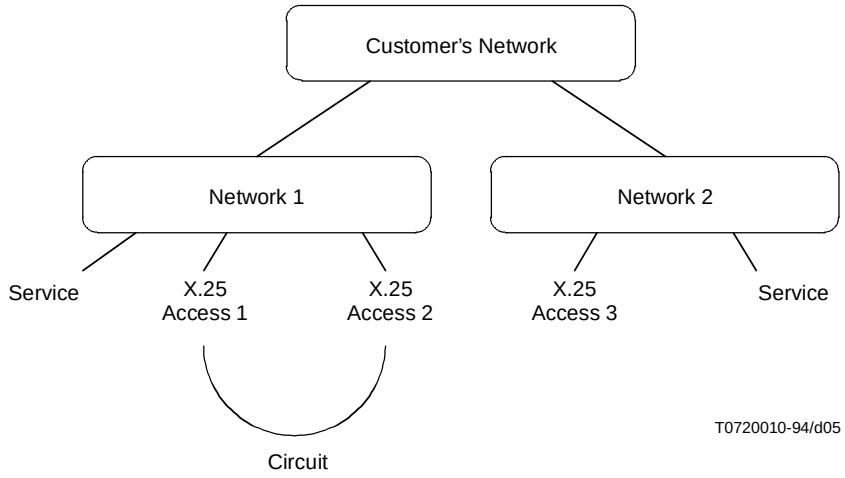

Figure C.5/X.161 – Customer's network view

Partial inquiries require the specification of criteria for the selective retrieval of information. In general this requires means of specifying and communicating "and", "or", nesting relationships, and so on. One way of supporting these requirements could be to reveal some of the Service Provider's database structure. A "catalogue" elementary service could be used so long as this supports nesting and logical relationships.

The logical division of service inquiries according to the user's view is depicted in Figure C.6.

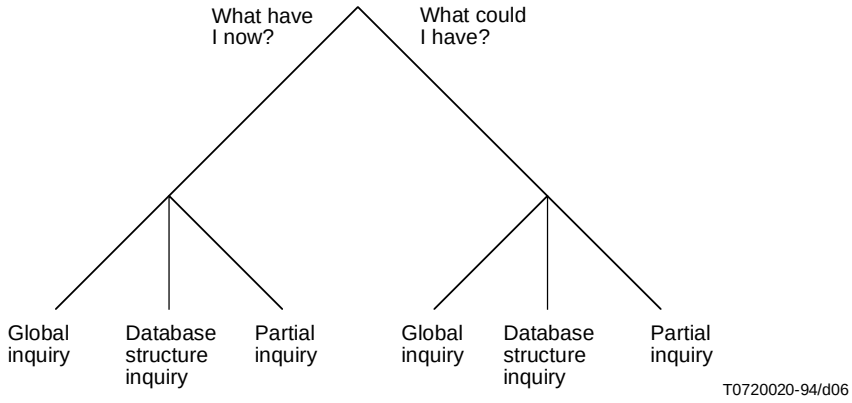

Figure C.6/X.161 – Inquiry relationships

C.3.2 Service Reconfiguration

This function is for further study.

C.3.3 Ordering Service

This may be divided into the following functions:

– service subscription;

– service reconfiguration (implying change to the contract);

– service cancellation.

C.3.3.1 X.25 Ordering

This is a specific example. Entity-relationship techniques can be used to model the basic data that could then be mapped to EDIFACT data items, or ASN.1 Managed Objects for use with CMIP. Business process rules can be used to define the flow of information. A pictorial example for an order for an X.25 line is given in Figure C.7.

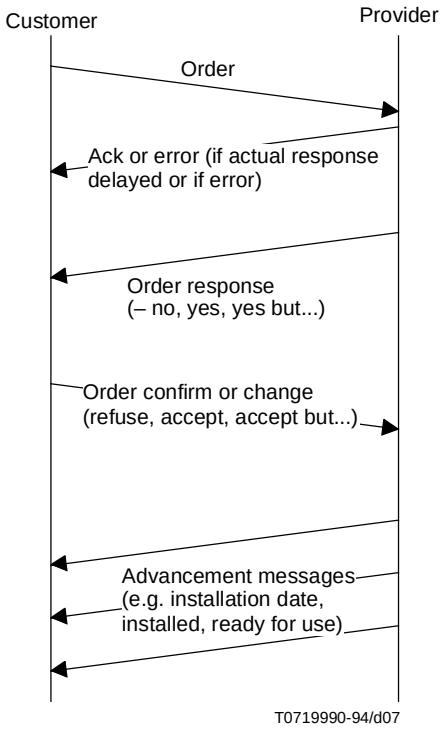

Figure C.7/X.161 – Information flow for an X.25 line

C.3.4 Inventory inquiry

This function is for further study.

C.3.5 Systematic call redirection

This function is for further study.

C.4 Accounting Services

The Accounting Management service group is divided into the following functions:

– periodic billing;

– detailed accounting, such as tariff communications (e.g. price lists);

– quota control;

– real-time charging information.

C.4.1 Periodic billing

This function is for further study.

C.4.2 Detailed accounting

This function is for further study.

C.4.3 Quota control

This function is for further study.

C.4.4 Real-time charging information

This function is for further study.

C.5 Performance Management Service

The Performance Management Service group is divided into the following functions:

– traffic information;

– Quality of Service information.

C.5.1 Traffic information

The Traffic information function is divided into the following elementary functions:

– statistics of access (at a port);

– statistics of performance;

– network statistic (overall pattern of calls – get from billing system).

Information for the first two items would come from the network itself and concern statistics such as volume transmitted, duration, number of calls on a line, number of rejected calls and so on.

C.5.2 Quality of Service information

This function is for further study.

C.6 Security Management

This whole service group is for further study. At present it is intended to provide the following functions.

C.6.1 Password change

This function is for further study.

C.6.2 Access rights

This function is for further study.

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