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MAINTENANCE: TELECOMMUNICATIONS MANAGEMENT NETWORK

TMN MANAGEMENT SERVICES: OVERVIEW

Recommendation M.3200

FOREWORD

The CCITT (the International Telegraph and Telephone Consultative Committee) is a permanent organ of the International Telecommunication Union (ITU). CCITT is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

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Recommendation M.3200 was prepared by Study Group IV and was approved under the Resolution No. 2 procedure on the 5th of October 1992.

CCITT NOTE

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

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Recommendation M.3200

TMN MANAGEMENT SERVICES: OVERVIEW

(1992)

Abstract

This Recommendation contains information resulting from TIBS A and B of the Recommendation M.3020 [1]. The information will be used by the object modelling teams to provide a basis to the Recommendation M.3100 [2] and specific network models. It therefore provides a link between the TMN methodology and network models. This information may also provide a basis from which an Administration compiles its own Telecommunication management services.

Keywords used in this Recommendation:

– Telecommunications Management Network;

– Management Service;

– object modelling;

– Management Service component;

– Task Information Base;

– Mediation Device.

1 Purpose

This Recommendation provides the introduction to a series of Recommendations in which Telecommunication Management Network Management Services (TMN-MS) are described. A TMN management service is seen as an area of management activity which provides for the support of an aspect of Operations, Administration and Maintenance (OAM) of the network being managed, described from the user perception of the OAM requirements. Recommendation M.3010 [23] specifies the architecture which details the physical and functional components that support the TMN management services. The use of the terms Network Element (NE) and Operations Systems (OS) includes the concepts of functions, i.e. NEF and OSF. This Recommendation does not imply any implementation aspects of functions within physical building blocks.

As such it is the aim of the management interfaces to support these requirements even if not all the services are provided by automated equipment [e.g. the Operations Systems (OS) or Mediation Device (MD)]. The TMN MS as such will not be subject to standardization. However, the list of TMN MSs will provide a check list to guide the standardization process, for the functions, objects and messages, ensuring that it supplies all the functionality that is necessary to support the perceived usage of the management implementation. Existing Recommendations are being used as a base for the definition of the TMN MSs.

Human operators interact with the existing management systems so as to realize many TMN MSs. It is the aim of standardization to allow for the continuing automation of these services so as to enhance the efficiency of the MS tools for the human operators.

2 TM management services (TMN MSs)

TMN MSs are an integral part of TMN interface specifications. They are defined as part of Task 1 of the TMN interface-definition methodology which is documented in Recommendation M.3020 [1].

The list of TMN MSs which have been identified is contained in Annex A. For those MSs which have already been defined, the list indicates the Recommendation where the definition may be found. Other MSs are for further study and more may be identified.

Each TMN MS will contain the following information:

– a specification of the TMN MS in prose form (see Annex B);

– a specification of the TMN MS components which are used by the TMN MS. An example of the MS component "Alarm Surveillance" can be found in Annex C;

– a specification of the TMN management functions which are used by the TMN MS components.

A list of potentially useful functions may be found in Recommendation M.3400 [3]. However, if the needs of a MS are not to be found in M.3400 [3] then a new function should be described. If any of these newly defined functions are seen as reusable over other MSs, then it should be seen as a candidate for inclusion in M.3400 [3].

Thus, the TMN MS Recommendations include the Task Information Bases (TIBs) A and B as identified in Recommendation M.3020 [1].

3 An example of a tool for the definition of a TMN MS

3.1 *TMN MSs template*

3.1.1 *Template description*

In specifying a TMN MS it is necessary to cover all functional areas to ensure that the total functional requirements are addressed. The following text describes a tool called a TMN MS template. The use of this tool helps to ensure complete coverage of the functional requirements of a Management Service. This is achieved by the relationship of the concepts contained within hierarchical management, e.g. layering to all possible functional areas of management, e.g. performance management, fault management, accounting management etc. A pictorial representation of the template can be found in Figure 1/M.3200.

The template is two-dimensional, the first dimension being the logical representation of an Administration's management hierarchy and the second being a list of those management functional areas to be covered. All of the resultant boxes within the template need to be addressed, although some may be redundant depending on the specific MS being defined.

It should be noted that the template is only one example of a tool that may be used and it does not restrict the reader in implementing his or her own method of MS specification.

3.1.2 *Method of use*

The following is a step-by-step procedure of the use of the template:

1) Specify the TMN Management Service.

2) Work consistently through each box of the template. The output from each of the boxes will be a list of the TMN MS components which have been identified.

   Note – This process may at first result in a list of functions.

3) Expand each component into its respective functions.

   Note – The use of stages 1 to 3 of the above, would be equivalent to TIBs A and B of the TMN methodology.

As a result of the above procedure, it may be possible to identify specific objects. The analysis of each of the objects will ensure that all the functional specifications have been fully addressed and may result in further additions to the function list. As an aid to the reader, the expansion of one of the boxes is given in Figure 2/M.3200, which shows how the template is used.

The results of the use of such a tool as given above, can be found in two examples annexed to this Recommendation. These two examples "Traffic Management" (see Annex D) and "Common Channel Signalling Systems" (see Annex E), are not the final product and are only included as examples.

Functional areas / Layer	a Fault	b Configuration	c Performance	d Security	e Accounting	f Others (Note)
1 Business management						
2 Service management						
3 Network management						
4 Element management						

Note – More functional areas could be added such as, Design/Planning, Provision, Forecast, Monitor, etc.

FIGURE 1/M.3200

Example of TMN Management Service template

	Performance
	TMN management service components
	1) Circuit groups
Service management	2) Switching nodes
	3) etc.
	4) ...
	5) ...

The following is an expansion of the above components into functions:

1) *Circuit groups*
   a) Report circuit group data parameters on a scheduled/demand basis
   b) Set performance information attributes
   c) etc.

2) *Switching nodes*
   a) Report exchange load measurements on a scheduled/demand basis
   b) Report exchange congestion measurements
   c) etc.

FIGURE 2/M.3200

Example of the expansion of one box from Figure 1/M.3200

4 Relation of TMN MSs to TMN entities

TMN MSs are groupings of specific TMN management functions which provide for the management of telecommunications equipment. There is no direct relationship between a TMN MS and a physical OS[1)].

The TMN MSs may be grouped into OSs as best meets the organizational needs of the Administration operating a TMN. One or more OSs may thus perform several MSs or conversely a given TMN MS may be distributed over several OSs. The allocation of these TMN management functions to the OSs is not a subject for standardization.

ANNEX A

(to Recommendation M.3200)

List of TMN management services

1 Customer administration.

2 Routing and digit analysis administration.

3 Traffic measurement and analysis administration.

4 Tariff and charging administration (includes accounting).

5 Management of the security of TMN.

6 Traffic management.

7 Management of customer access.

8 Management of transport networks. This service will include aspects of

- circuits, including telephone type, leased and special;
- paths;
- links, including international data transmission systems.

9 Switching management.

10 Management of equipment in customer premises.

11 System installation administration.

12 Quality of Service and network performance administration.

13 Management of the customer controlled service.

14 Common Channel Signalling System management.

15 Management of intelligent networks.

16 Restoration and recovery.

17 Materials management.

18 Staff work scheduling.

19 Management of the TMN.

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1) For the descriptions in this Recommendation it has been assumed that all the OS functionality associated with a Management Service/component/function is contained within the OSs and all the corresponding NE functionality is contained within the NEs. This assumption is not intended to restrict the services but rather simplify their description.

The above list is only meant as a guide and is not intended to be exhaustive. Further revisions of this may have additions. See Annex B for prose descriptions of some of the above MSs.

Note 1 – This list of TMN MSs should be refined with the help of the Working Parties and Study Groups which have expertise in specific areas covered by these TMN-MSs (e.g. Study Groups II, IV, XI, XV).

Note 2 – Some TMN MSs which are identified above may be too large in scope to handle as single services. The possible sub-division of these services is for further study.

ANNEX B

(to Recommendation M.3200)

(refer to the list in Annex A)

TMN management services prose descriptions

B.1 *Customer administration*

Customer administration is a management activity that the network operator performs in order to exchange with the customer, management data and functions required to offer a telecommunication service, and to exchange with the network all the customer-related management data and functions necessary for the network to produce that telecommunication service. This could include interactions for the purpose of service provisioning management, configuration administration, fault administration, charging (including detailed billing) administration, complaints administration, quality of service administration, traffic measurement administration, etc. Here, however, only customer administration in the more traditional sense of service provisioning, service configuration and complaints management has been included.

B.2 *Routing and digit analysis administration*

The purpose of management of routing information in an exchange is to allow either a traffic or a routing manager to change the static routing information dynamically. For traffic management purposes the requirements as specified in Recommendation E.412 [4] should be met.

In specifying the aspects of management for routing, certain requirement must be met:

- it must be possible to verify routing information in an exchange, with a minimal distortion in the normal operation of an exchange;
- it must be possible to switch between routing tables according to a pre-defined timing schedule, e.g. by introducing scheduling for routing tables;
- define functionality in such a way that routing tables may be changed easily;
- avoid redundant information by making use of objects which exist during run time;
- it must be possible to expand the model with future requirements, therefore the specification of object classes for routing purposes must be expandable.

B.3 *Traffic measurement and analysis administration*

For further study.

B.4 *Tariff and charging administration*

The tariff and charging administration covers the part of the management activities related to the tariffs in the network elements and to the charging data for service usage. The activities may include creation, interrogation, modification and deletion of data and the management of the data collection process. The activities include all methods used to verify that the charging data is correct.

The TMN may enhance this management service by providing faster, more extensive and more reliable data collecting possibilities from NE and data administration possibility remotely through OS to NE.

B.5 *Management of the security of the TMN*

For further study.

B.6 *Traffic management*

This TMN MS is concerned with the management of traffic associated with circuit switched networks [e.g. Public Switched Telephone Network (PSTN), ISDN] and transmission networks, (e.g. the SDH network). The object of traffic management is to enable as many calls as possible to be successfully completed. The objective is met by maximizing the use of all available equipment and facilities in any traffic situation. It is also seen as the function of supervising the performance of a network, and to be able, when necessary, to take the action to control the flow of traffic, and to optimize the maximum utilization of the network capacity.

As a first attempt, and to ensure an ease of specification this service will initially concern itself with the NE, a digital exchange network element.

The TMN MS will collect traffic information from the NE and send commands to that NE to modify its operation and or to reconfigure the network. The NE may send traffic management information periodically or upon threshold triggering. The TMN MS may alter the thresholds at which the NE sends the traffic data and/or the periodic time reports. The data sent from the NE may be processed within the TMN MS, via MDs or OSs.

In order for the Digital exchange NE, to accomplish the above, it will need to perform the following:

– collect traffic management information by the use of an internal measurement sub-system;

– process traffic management information (this will be done by processing the information from the measurement sub-system and converting it to a recognized set of traffic management indicators);

– transfer the recognized set of traffic management indicators to the OS;

– receive control information from the OS, and execute the appropriate controls to affect the traffic flow.

The OS should be able to collect all the traffic management indicators to obtain an overall view of the status of the Network.

During the description and specification of the traffic management information it is usual to take into account aspects of common channel signalling and traffic measurement. TMN at present consists of many TMN MSs, two of which are the previously mentioned services. During the specification of these MSs an attempt has been made to separate aspects of common channel signalling and traffic measurement from traffic management. This attempt has been made so as to ease the task of specifying management services. However, if during further passes of the TMN methodology it becomes clear that these management services cannot be separated, then attempts will be made to include them in future versions.

B.7 *Management of customer access*

Management of customer access belongs or relates to that part of the local network that extends from the network terminating equipment up to and including the exchange termination. This must take into account any equipment associated with the customer access including multiplex equipment, network terminating units etc., regardless of whether they are narrow-band or broadband, analogue or digital.

The term management also describes configuration, failure monitoring and fault analysis, security and network performance of any part or piece of equipment associated with the access. It should also take into account separate requirements resulting from circuit-switched or packet-switched environments.

Because of its complexity, customer access can no longer be regarded as consisting of copper wires and network terminating equipment. It may now consist of copper wires or optical fibre along with complex electronic equipment whose functions may need to be updated, or changed by the network provider. Therefore, the access needs management control facilities so that these functions may be operated upon.

B.8 *Management of transport network*

B.8.1 *Management of telephone-type circuits*

Management of telephone-type circuits between exchanges and associated equipment, covers all those functions necessary for bringing into service and maintaining analogue and digital circuits between exchanges. This may also include recorded information services and other circuit related equipment such as echo cancellers. A circuit is terminated at its two access points.

Telephone-type circuits are defined as physical links such as junctions, private wires, data and digital circuits. These analogue and digital circuits originate and terminate at their respective switching point and may be a mixture of circuits originating as analogue and terminating as digital. An analogue telephone type circuit is defined as a circuit between two analogue telephone exchanges, and which is provided with analogue transmission throughout. The circuit is terminated by its two access points.

A digital telephone type circuit is defined as a circuit between digital exchanges and is provided with digital transmission throughout. Access to the circuit in the circuit access point can be obtained via the digital switches.

A mixed analogue/digital telephone type circuit is defined as a circuit between two analogue or digital exchanges and provided with a mixed analogue/digital transmission system. A mixed analogue/digital circuit is a circuit which includes one or more analogue/digital converters.

B.8.2 *Management of leased and special circuits*

Management of leased and special circuits cover those functions necessary for bringing into service and maintaining analogue and digital international leased and special circuits.

One of these types of circuits has analogue presentation at the customers' premises and the other type has digital presentation at the customers' premises.

B.8.3 *Management of transmission paths*

Management of transmission paths covers all those functions necessary for bringing into service and maintaining transmission paths, including monitoring and performance of the paths. A transmission path is defined as the whole of the means of transmitting and receiving a transmission signal of specified rate or bandwidth between two distribution frames (or equivalent) at which terminal equipment or switches will be connected. Terminal equipments are those at which signals at the specified bit rate or bandwidth originate or terminate and may include multiplexing and demultiplexing.

B.8.4 *Management of transmission links*

Management of transmission links covers those functions necessary for bringing into service and maintaining analogue and digital transmission links.

Transmission links include international data transmission systems which offer transmission links for international leased and special circuits. They also include all equipment associated with the links, e.g. regenerators, line terminals.

B.8.5 *Transport network concept*

Management of transport networks covers all those functions necessary for bringing into service and maintaining trails, including monitoring the performance of the trail. The trail is characterized by the responsibility, in a service layer, of the integrity of transfer of characteristic information from one or more client network layers between service layer access points. It is formed by combining a near end trail termination function, a network connection function and a far end trail termination function. A trail termination has the responsibility of generating the characteristic information of a network layer and ensures its integrity. For example:

– in SDH, a trail could be defined as a lower order path or a higher order path. Adaptation functions could be done by a digital multiplex or connection functions by a digital cross-connect;

– in PDH, a trail could be defined as a path. Adaptation functions could be done by a multiplex or a line system;

– in ATM, a trail could be defined as a virtual channel or virtual path. Connection functions could be done by switching.

All these concepts are described in the work of Study Group XV on "Generic functional architecture of transport networks".

B.9 *Switching management*

A digital Exchange (NE) includes functions as specified in Q.500-Series Recommendations [5]. One function is switching. This section describes the management needed for switching. Management of other functions included in the exchange, will be described in separate texts.

This section is based on the Q.500-Series Recommendations [5]. The same general principles will be used for all bit rates. The NE may consist of one or more entities. These entities can be placed at different locations. One entity may provide a Q3 interface, which is common for all entities in one exchange. The NE is built up of hardware and software. The hardware is divided in a number of replaceable units (RPUs) and the software in a number of reloadable units (RLUs).

B.9.1 *Definition*

The management service "Switching Management" covers the functions for switching included in the exchange. The design objectives and interfaces for exchanges are specified in the Q.500-Series Recommendations [5]. These Recommendations are used as a base for the work with management services which concern exchanges.

B.9.2 *Scope*

The scope of the management service "Switching Management" is to provide management functions needed to meet the requirements on service quality stated in the Q.500-Series Recommendations [5]. The exchange NE may consist of one or more entities. Entities are provided with functions for management. However, reports from the NE to OS via the Q3 interface include identification of faulty RPUs and RLUs independent of where the concerned RPUs and RLUs are placed in the NE. The geographic addresses of the entities are stored in the OS. The number of entities in a NE depends on the system design and the size and distribution of the population that the particular digital change serves.

The management service will include functions for:

– performance management;

– fault (maintenance) management;

– configuration management.

The management functions in the NE include supervision. An alarm is generated if a fault occurs which leads to degradation of performance. The performance provided by the NE depends on the switching functions, the transmission quality through the switch and the availability. The following reports concerning objects are sent from the NE to the OS:

– *Degradation of the performance*

  These reports will be based on attributes for abstract objects, in this case, related to parts in the switching network.

– *Faulty objects*

  An object can be an NE, RPU or RLU. When the reports concern RPUs or RLUs the identification code will be included for the RPUs or RLUs which have been identified as faulty by the functions in the NE. The identification code will consist of two parts:

  a) standard;

  b) system unique.

Test of the objects shall be possible from the OS.

B.9.3 *Other Recommendations*

The NEs which will be connected to the OS via a Q3-interface are specified in other Recommendations. The following Recommendations will be used as a basis for the work on the modelling of the management service "Switching Management": Q.531 [6], Q.512 [7], Q.513 [8], Q.521 [9] and Q.542 [10].

B.10 *Management of equipment in customer premises*

For further study.

B.11 *System installation administration*

For further study.

B.12 *Quality of Service and network performance administration*

For further study.

B.13 *Management of the customer controlled service*

For further study.

B.14 *Common Channel Signalling System management*

This TMN management service covers all those aspects concerned with the management of CCSSs. In describing the process of managing a CCSS, it is necessary to take into account events and information outside of the sphere of this management service. An example of this may be the failure of a transmission system over which the signalling traffic is carried. This information will need to be taken into account to ensure efficient utilisation of the network.

To this end it will be necessary to have a network wide view of the availability of the signalling network and the signalling traffic loading. In some network situations, only information relating to a particular node and the nodes connected to it are known. Problems beyond this node, such as congestion, may add complications, if the node is used as a Signalling Transfer Point (STP). Therefore the network wide view should at least contain the following relevant information:

– configuration of the signalling network;

– the availability or non-availability of each signalling link set and its capacity;

– the current loading of each link set;

– indication of the initiation of internal flow control procedures.

– information contained in Recommendations Q.750 [11], Q.751 [12], Q.752 [13], Q.753 [14], and Q.754 [15].

The information gathered will be in the form of statistical measurements. These measurements will be gathered from within and from outside of the signalling system concerned. The type of measurements needed have been taken from Recommendation Q.791 [16]. Where appropriate additional information has been added.

CCSS management will also take into account planning and should make use of computer based tools. These tools could contain information such as:

– a map of the network containing all signalling points and STPs, signalling routes and their capacities;

– detection of signalling link sets requiring additional capacity;

– interconnection with transmission planning information to ensure the required diversity of transmission paths;

– etc.

The management system should provide the ability to manipulate signalling resources through a Human-Machine Interface (HMI). Some of the types of information that could be accessed/altered include:

– control signalling link states;

– introduce new routes;

– reporting of fault conditions;

– collection of statistics;

– change routes.

B.15 *Management of intelligent networks*

For further study.

B.16 *Restoration and recovery*

For further study.

B.17 *Materials management*

Materials management of stores, exchanges, transmission equipment and other parts of a telecommunication network enables the network operator to do the required installation work and maintenance. It allows calculation of the cost of a service offered to the customers and improvement in the planning of a telecommunication network.

B.18 *Staff work scheduling*

The quality of telecommunication services offered to the customer depends very much on the network operator's staff. Although this management service has no direct influence on NEs, it should be considered that effective staff work scheduling helps to keep the staff effort at an economic level.

Accordingly, staff work scheduling is a management activity of the network operator in order to despatch the appropriate staff member for the work to be performed. This is valid not only for OAM of the NEs, but also for the maintenance and installation work to be carried out at the customers' premises. Furthermore, the staff has to be scheduled for installation or repair work in the field, e.g. for cables, microwaves, etc.

B.19 *Management of the TMN*

For further study.

ANNEX C

(to Recommendation M.3200)

Alarm surveillance management service component

C.1 *Scope*

Alarm surveillance has been identified as a management service component for many TMN management services, for examples, Switching Management, Transport Management and Traffic Management all require alarm surveillance.

This Annex describes the generic requirements to enable the TMN to perform alarm surveillance of NEs in a standard fashion. (Recommendation Q.821 [17] describes a Q3-interface definition for this alarm surveillance service component.)

C.2 *Description*

Alarm surveillance provides the capabilities needed to monitor and or interrogate NEs about alarm events or conditions. Alarm information is generated by a NE upon the detection of a fault or an abnormal condition. Examples of such alarms are: detection of transmission data errors, the crossing of a performance threshold, and the detection of faulty equipment. Alarm information can be reported at the time of occurrence, and/or logged for future access. An alarm may also cause further management actions within the NE that lead to the generation of other fault management data.

In order to enable the TMN to perform alarm surveillance, NEs must

– allow monitoring of alarm conditions in a near-real time or scheduled manner;

– allow querying of alarm conditions existing on the NE;

– allow conditioning of alarm reporting;

– allow logging and retrieval of historical alarm information.

The alarm surveillance functions required to meet these requirements can be categorized as follows (see Recommendation M.3400 [3]).

– alarm reporting functions;

– alarm summary reporting functions;

– alarm event criteria functions;

– alarm indication management functions;

– log control functions.

These are described in further detail in the following text.

C.2.1 *Alarm reporting functions*

C.2.1.1 *Requirements*

The requirements satisfied by these functions are the reporting and the control of reporting of alarms and related information, in a standard fashion. These functions support the asynchronous reporting of alarm conditions.

C.2.1.2 *Model*

Alarms are specific types of notifications concerning detected faults or abnormal conditions. An alarm notification results from an alarm condition which persists long enough to qualify as a non-transient condition as determined by some algorithm applied to the condition. Such an algorithm may be simple (e.g. “all occurrences of the condition shall be treated as alarms”) or complex (e.g. by applying one of the defined threshold types to the condition). When an alarm condition exists, the affected managed object has an “ACTIVE-REPORTABLE” alarm status.

Similarly, when the alarm condition ceases to exist, an alarm notification is generated to report clearing of the alarm. The affected managed object's alarm status is "CLEARED".

When some condition has been recognized but has not persisted long enough to qualify as a non-transient condition (as determined by some algorithm applied to the condition), the affected managed object's alarm status becomes "ACTIVE-PENDING". In the case of a "null" algorithm (i.e. all occurrences of the condition are treated as non-transient), or when the transient conditions can occur too frequently to be meaningfully monitored, the "ACTIVE-PENDING" status will not exist.

Figure C-1/M.3200 illustrates the states and transitions related to the alarm status of managed objects.

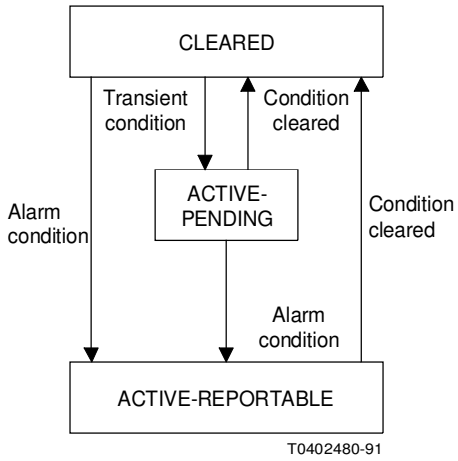

FIGURE C-1/M.3200

Status and transitions related to the alarm status of managed objects

An NE must provide a mechanism for the control of notification, e.g. whether an alarm condition results in an alarm report to the TMN. The requirements to be satisfied are

- the definition of a flexible alarm report control mechanism which will allow systems to select which alarm reports are to be sent to the TMN;
- specification of the destination to which the alarm reports are to be sent;
- specification of a mechanism to control the forwarding of alarm reports, for example, by suspending and resuming their forwarding;
- the ability for the TMN to modify the conditions used in the reporting of alarm conditions.

C.2.1.3 *Management functions*

The management functions needed to address the requirements specified above are the following (these management functions are described in Recommendation M.3400 [3]):

- report alarm,
- route alarm report,
- request alarm report route,
- condition alarm reporting,
- request alarm report control condition,
- allow/inhibit alarm reporting.

C.2.2 *Alarm summary reporting functions*

C.2.2.1 *Requirements*

The requirements satisfied by these functions are the reporting, and the control of reporting, of a summary of the current alarm conditions of specified managed objects. These functions support the reporting of alarm conditions in a scheduled and/or on demand basis.

The requirements to be satisfied are

– the definition of a flexible current alarm summary control mechanism which will allow a system to provide a summary of current alarm conditions for specified managed objects to the TMN, periodically or upon request;

– the specification of the destination to which the alarm summary reports are to be sent;

– the specification of a mechanism to control the forwarding of alarm summary reports, for example, by suspending and resuming their forwarding;

– the ability for the TMN to modify the conditions used in the reporting of alarm summary reports.

C.2.2.2 *Model*

The model for current alarm summary reporting describes the conceptual components that provide for the collation of current alarms into a current alarm summary report. The alarms are received from specified managed objects and satisfy defined conditions. The reporting may be on a scheduled or on-demand basis.

The current alarm summary control is used to provide the current alarm summary report for the specified managed objects and condition. It is provided in response to a message from the management operation scheduler or a specific request from the TMN to retrieve the current alarm summary report.

Figure C-2/M.3200 is a schematic representation of the components involved in generating, and reporting current alarm summary reports.

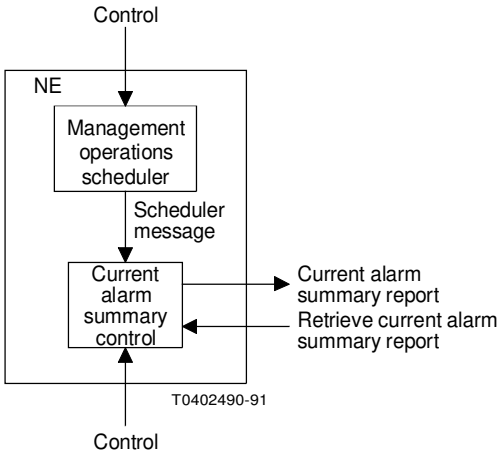

FIGURE C-2/M.3200

Current alarm summary report

C.2.2.3 *Management functions*

The management functions needed to address the requirements specified above are the following (these management functions are described in Recommendation M.3400 [3]):

- report current alarm summary;
- route current alarm summary;
- request current alarm summary route;
- schedule current alarm summary;
- request current alarm summary schedule;
- allow/inhibit current alarm summary;
- request current alarm summary.

C.2.3 *Alarm event criteria functions*

C.2.3.1 *Requirements*

The requirement satisfied by these functions is the management of the criteria used to determine when a certain condition is to be considered an alarm.

The alarm event criteria functions allow for the assignment of specified attributes (e.g. thresholds, etc.) used by the NE to determine if a condition is to be considered an alarm.

C.2.3.2 *Model*

For further study.

C.2.3.3 *Management functions*

The management functions needed to address the requirements specified above are the following (these management functions are described in Recommendation M.3400 [3]):

- Condition alarm event criteria;
- Request alarm event criteria.

C.2.4 *Alarm indication management functions*

C.2.4.1 *Requirement*

The requirement satisfied by these functions is the control of audible/visual alarm indications.

C.2.4.2 *Model*

For further study.

C.2.4.3 *Management functions*

The management functions needed to address the requirements specified above are the following (these management functions are described in Recommendation M.3400 [3]):

- Inhibit/allow audible/visual alarm indications;
- Reset audible/visual alarm.

C.2.5 *Log control functions*

C.2.5.1 *Requirements*

The requirements satisfied by these functions are the control of the logging and the retrieval of alarm history for an NE.

The requirements to be satisfied are

– the definition of a flexible log control mechanism which will allow selection of alarms that are to be logged by a management system in a particular log;

– the ability for the TMN to modify the criteria used in logging alarms;

– the ability for the TMN to determine whether the logging characteristics were modified or whether alarm records have been lost;

– the specification of a mechanism to control the time during which logging occurs, for example by suspending and resuming logging;

– the ability for the TMN to retrieve alarm records from the log;

– the ability for the TMN to create and delete logs.

Note that these requirements do not include the option of deleting alarm records from a log. This is to ensure that a complete audit trail of alarm reports is maintained.

C.2.5.2 *Model*

For the purpose of alarm surveillance, it is necessary to preserve information about alarm reports that have occurred as a result of alarm reports on managed objects. Alarm records, in the log, contain the information from their corresponding alarm reports.

The model for the log control functions describes the conceptual components that provide for the logging and retrieval of alarm information.

Figure C-3/M.3200 is a schematic description of the alarm logging capability.

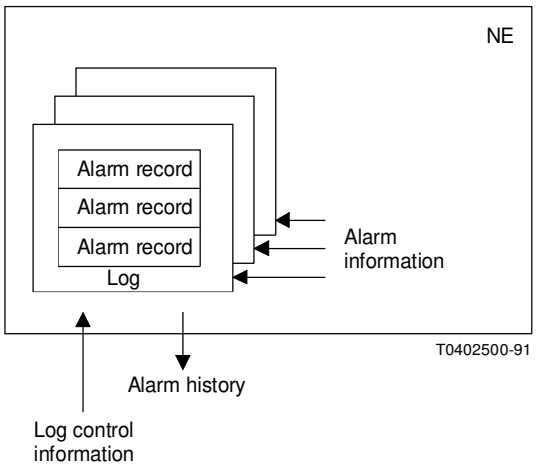

FIGURE C-3/M.3200

Alarm logging capability

C.2.5.3 *Management functions*

The management functions needed to address the requirements specified above are the following (these management functions are described in Recommendation M.3400 [3]):

– allow/inhibit logging,

– condition logging,

– request logging condition,

– request alarm history.

ANNEX D

(to Recommendation M.3200)

TMN management service "Traffic Management"

The final specification of this management service is under study. The reader should particularly note that the functions contained in TIB B may be modified or removed

TIB A

Description of TIB A

This TMN MS is concerned with the management of traffic associated with circuit switched networks [e.g. Public Switched Telephone Network (PSTN), ISDN] and transmission networks, (e.g. the SDH network). The object of traffic management is to enable as many calls as possible to be successfully completed. The objective is met by maximizing the use of all available equipment and facilities in any traffic situation. It is also seen as the function of supervising the performance of a network, and to be able, when necessary, to take the action to control the flow of traffic, and to optimize the maximum utilization of the network capacity.

As a first attempt, and to ensure an ease of specification this service will initially concern itself with the NE, a digital exchange network element.

The TMN MS will collect traffic information from the NE and send commands to that NE to modify its operation and or to reconfigure the network. The NE may send traffic management information periodically or upon threshold triggering. The TMN MS may alter the thresholds at which the NE sends the traffic data and/or the periodic time reports. The data sent from the NE may be processed within the TMN MS, via MDs or OSs.

In order for the Digital exchange NE, to accomplish the above, it will need to perform the following:

– collect traffic management information by the use of an internal measurement sub-system;

– process traffic management information (this will be done by processing the information from the measurement sub-system and converting it to a recognized set of traffic management indicators);

– transfer the recognized set of traffic management indicators to the OS;

– receive control information from the OS, and execute the appropriate controls to affect the traffic flow.

The OS should be able to collect all the traffic management indicators to obtain an overall view of the status of the Network.

During the description and specification of the traffic management information it is usual to take into account aspects of common channel signalling and traffic measurement. TMN at present consists of many TMN MSs, two of which are the previously mentioned services. During the specification of these MSs an attempt has been made to separate aspects of common channel signalling and traffic measurement from traffic management. This attempt has been made so as to ease the task of specifying management services. However, if during further passes of the TMN methodology it becomes clear that these management services cannot be separated, then attempts will be made to include them in future versions.

During the compilation of this management service, references were taken from the following documents:

– Recommendations E.411 [18], E.412 [4], E.413 [19], Q.541 [20], Q.542 [10], Z.337 [21];

– ANS1 T1 210-199X;

– CCITT Handbook on quality of service, network management and network maintenance;

– ETSI Draft TR "TMN Management Services".

If further information is needed, it is recommended that the reader refer to the E.400-Series [22] Recommendations.

Components of service of TIB A

D.1 *Network status and monitoring*

This is the periodical or spontaneous collection of information about network status and traffic performance on digital resources of the telecommunication network.

This information can be provided as data, parameters and/or indicators. Network status information includes

D.1.1 *Circuit groups*

Aspects of status information, e.g.:

- status of all circuit groups available to a destination;
- status of individual circuit sub-groups in circuit group;
- status of circuits in each circuit group.

Aspects of the status indicators e.g.:

- when all circuits in a circuit group are busy;
- when all circuits in a circuit sub-group are busy;
- when all circuit groups to a destination are busy[2] .

D.1.2 *Switching nodes*

- *Load measurements* – These are provided by call bids, usage or occupancy data, on the per cent of real time capacity available or in use, percentage of equipment in use, counts of second attempts, etc.
- *Congestion measurements* – These are provided by measurements of the delay in serving incoming calls, holding times of equipment, average call processing and set up time, queue lengths for common control equipment or software queues, counts of equipment time-outs, etc.
- *Service availability of exchange equipment* – This information will show when items of equipment are made busy for traffic.
- *Congestion indicators* – In addition to the above, indicators can be provided by digital exchanges which show the degree of congestion. These indicators can show:
  - no congestion (level 0);
  - moderate congestion (level 1);
  - serious congestion (level 2);
  - unable to process calls (level 3).

Hard-to-Reach (HTR) Destinations

The HTR indicator reflects the status of the availability/occupancy of the circuit groups of a particular destination (route).

D.2 *Network performance monitoring*

Network performance information includes:

- traffic on each circuit group;
- traffic to each destination;
- traffic to each digital exchange.

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[2] Refer to E.400-Series for further definitions of "busy".

Network performance data is generally expressed in parameters which help to identify difficulties in the network. Amongst these parameters are

- hard-to-reach (HTR);
- percentage overflow (% OFL);
- bids per circuit per hour (BCH);
- answer seizure ratio (ASR);
- answer bid ratio (ABR);
- seizures per circuit per hour (SCH);
- occupancy;
- mean holding time per seizure;
- busy-flash seizure ratio (BFSR).

For explanation of the above terms, see the E.400-Series Recommendations [22]. Collection of network performance information includes

- collection, on an event basis, or in periodical reports, of faults related to important failures of network resources;
- collection, on a request basis, of punctual values of measurements.

D.3 *Traffic management control actions*

For more detailed information see Recommendation E.412 [4].

D.3.1 *Protective action*

- *temporary removal of circuits from service (circuit busying)* – This action may be taken when a distant part of the network is experiencing serious congestion;
- special instructions to operators;
- special recorded announcements;
- *inhibiting overflow traffic* – This action prevents traffic from overflowing onto circuits groups or into distant exchanges which are already experiencing congestion;
- *inhibiting direct traffic* – This action reduces the traffic accessing a circuit group in order to reduce the loading on the distant network;
- *inhibiting traffic to a particular destination (code blocking or call gapping)* – This action may be taken when it is known that a distant part of the network is experiencing congestion;
- *circuit reservation* – This action reserves a number of idle circuits in a circuit group for a particular type of traffic.

D.3.2 *Expansive actions*

- establishing temporary alternative routing arrangements in addition to those normally available;
- temporary reorganizing the distribution of outgoing or incoming international traffic;
- establishing alternative routings into the national network for incoming international traffic;
- establishing alternative routings to an international exchange in the national network for originating international traffic.

The following is a list of typical traffic management controls, and is for further study:

1) Cancel to

2) Cancel from

3) Skip

4) Announcement change

5) Code blocking

6) Temporary alternative routing

7) Circuit directionalization

8) Selective circuit reservation

9) Call gapping

10) Circuit turndown/busy/blocking

D.4 *Access control*

For further study.

D.5 *Network traffic management functional architecture*

The Figure D-1/M.3200 shows the overall architecture of the network Traffic Management service. It depicts the main function blocks breaking down into those contained in the OS and NE on the one hand and the type of informations exchanged between them on the other hand.

The function "Observation Initiation" in the OS reacts to the operator requests received through the connected Work Station (WS) by transferring the measurement requests to the Network Element (NE). Measurement requests specify the characteristics of the measurement processes to be performed within the NE describing, e.g. the identification of the objects and their related attributes to be collected.

The function "Measurement" in the NE provides measurement processes for the generation of measurement data. Measurement data may be expressed by traffic indicators resulting from a preprocessing task within the NE. Measurement data will be then transferred to the OS for further network-wide analysis. All the parameters (e.g. thresholds), used for the generation of indicators, are to be manageable from the OS.

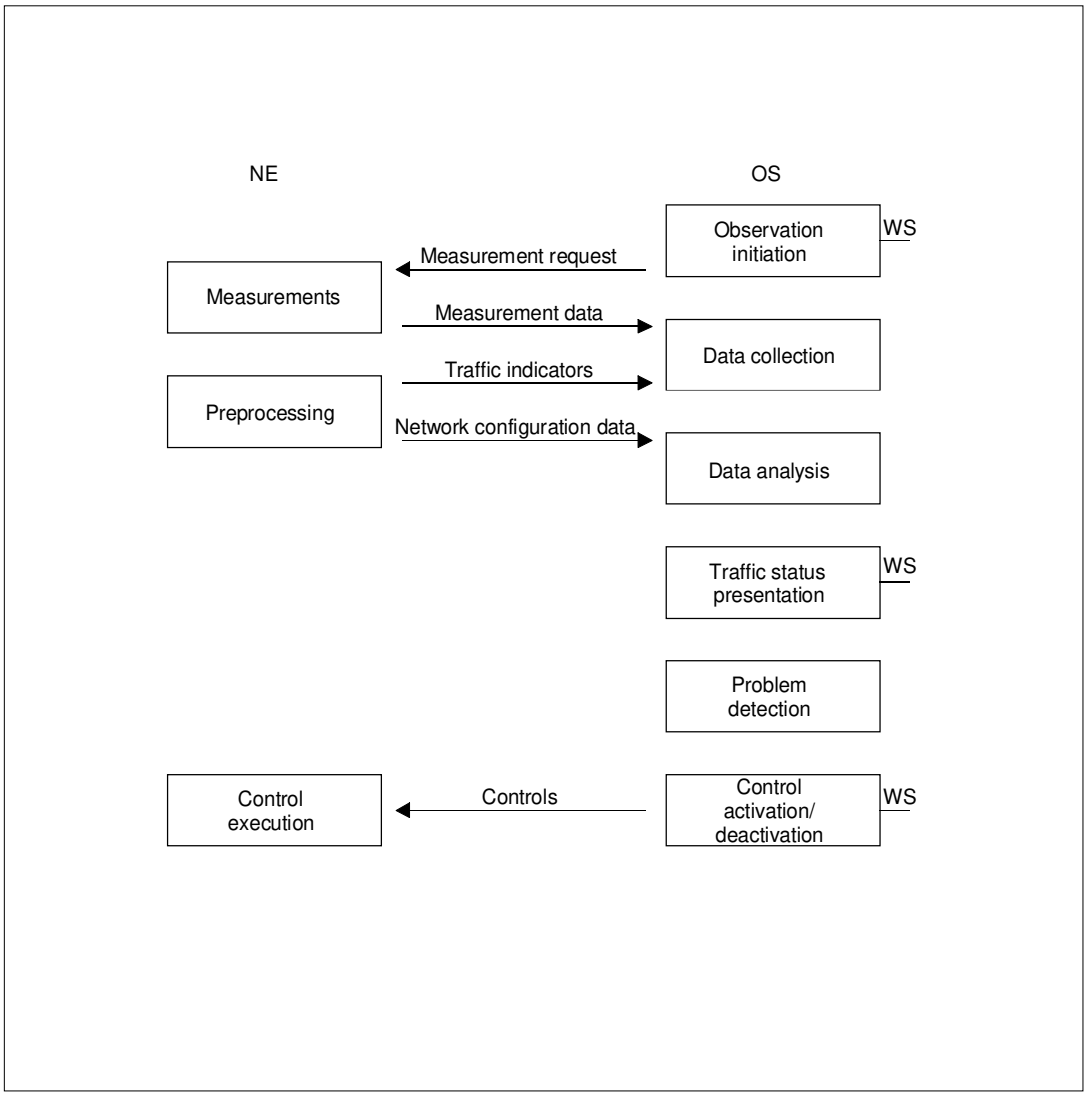
The function "Data collection" in the OS deals with the centralization of the measurement data received from the NE. Behind the data collection task, a data base system may be used for archiving the extensive volume of measurement data over long time period.

The function "Data analysis" in the OS is concerned with the derivation of traffic parameters from measured data. The data analysis is based on specified analysis algorithms which should be set and modified from the OS. Traffic parameters may describe traffic alarm occurrences, e.g. the crossing of a defined threshold.

The function "Traffic status presentation" offers the operator the ability to represent the actual network performance status in relation to the network configuration topology being considered.

The function "Problem detection" in the OS deals with the recognition of a trouble situation. The results of this task should deliver the operator all information identifying, e.g. the reason and magnitude of the degradation of the grade of service. Further, this task may result in a decision to apply traffic management control to affect the traffic flow.

The function "Control activation/deactivation" consists of the activation/deactivation of traffic management control by transferring the corresponding messages to the NE which apply/remove the control. The activation/deactivation of control has to reflect the decision made, e.g. by the operator through the WS.



NE Network Element
OS Operation System
WS Work Station

FIGURE D-1/M.3200

Architecture of the Traffic Management service

TIB B

Management function list

D.6 *Status monitoring functions*

D.6.1 *Report the service availability of the NE* – This function provides the service availability status of the exchange and its major components and processors, common channel signalling systems, interface equipment and other major exchange equipment units. Such reports may be generated automatically, or on demand.

D.6.2 *Report the status of controls on demand* – This function provides the current status of traffic controls which have been applied by an operator and automatic controls which have been established by an operator and applied by the exchange.

D.6.3 *Report the busy/idle status of circuit groups* – This function automatically reports the current busy/idle status of circuit groups for display on a terminal or other device.

D.6.4 *Report the congestion status of exchanges* – This function automatically reports the current congestion status of exchanges for display on a terminal or other device.

D.6.5 *Report status of hard-to-reach destinations* – This function provides current information on the Hard-to-Reach (HTR) status of network destinations. Such information can be based on messages received from distant exchanges or on information developed locally in the exchange.

D.6.6 *Add/remove HTR status of destinations* – This function allows an operator to manually assign/remove HTR status to/from destinations and override automatic HTR designations.

D.6.7 *Report the receipt of automatic congestion control signals* – This function automatically reports the receipt of congestion control signals received from distant exchanges. These signals automatically activate network management traffic controls in the local exchange.

D.6.8 *Request network status information* – This function provides the ability for the OS to poll the NE to receive specified network status information.

D.6.9 *Requested network status information report* – This function provides the ability for the NE to transmit on a request to the OS, a pre-defined report containing network status information.

D.6.10 *Periodical network status information report* – This function provides the ability for the NE to transmit specified network status information to the OS in a periodic report..

D.6.11 *Network status information report* – This function provides the ability for the NE to transmit on an event basis, specified network status information to the OS.

D.6.12 *Autonomous scheduled Network Traffic Monitoring (NTM) summary report* – This function provides the ability for the NE to transmit to the OS a report containing various NTM counters, measurements and flags on a periodic basis. The reports are sent automatically without the need for the OS to poll for the information.

D.6.13 *Request NTM summary report* – This function provides the ability for the OS to poll the NE and receive a pre-defined report containing various NTM counters, measurements and flags. This function differs from the previous function, only in that the report is polled, whereas in the previous, the report is sent autonomously.

D.6.14 *Autonomous unscheduled NTM event report* – This function provides the ability for the NE to transmit to the OS a message immediately upon occurrence of an event. These messages contain information, pertinent to the event being reported and can occur at any time. These messages could be generated in response to situations such as threshold crossings, automatic control activation or, reference data changing. This function deals only with the ability to generate these spontaneous messages.

D.6.15 *Request NTM measurements* – This function provides the ability for the OS to poll the NE and ask for the values of specific counters, flags or measurements. The OS specifies, in its request, the trunk groups, controls, etc. It also specifies which measurements it wants to see associated with each object. The NE responds with one or more messages giving the specific information requested.

This list is not exhaustive and is for further study.

D.7 *Network performance monitoring functions*

D.7.1 *Report circuit group data and parameters on a scheduled basis* – This function involves the reporting of circuit group traffic data and calculated network parameters automatically according to a schedule.

D.7.2 *Report circuit group data and parameters on demand* – This function involves the reporting of circuit group traffic data and calculated network parameters in response to an operator request.

D.7.3 *Report exchange load measurements on a scheduled basis* – This function involves the reporting of measurements of the traffic load on the exchange and its major components according to a schedule.

D.7.4 *Report exchange load measurements on demand* – This function involves the reporting of measurements of traffic load on the exchange and its major components in response to an operator request.

D.7.5 *Report exchange congestion on a scheduled basis* – This function involves the reporting of measurements of exchange switching congestion according to a schedule.

D.7.6 *Report exchange congestion measurements on demand* – This function involves the reporting of measurements of exchange switching congestion in response to an operator request.

D.7.7 *Report data on the performance of controls on a scheduled basis* – This function involves the reporting of data on traffic affected by network management controls on a scheduled basis.

D.7.8 *Report data on the performance of controls on demand* – This function involves the reporting of data on traffic affected by network management controls in response to an operator request.

D.7.9 *Request performance information* – This function provides the ability for the OS to poll the NE to receive specified performance information.

D.7.10 *Requested performance information report* – This function provides the ability for the NE to transmit on a requested basis, a pre-defined report containing specified performance information to the OS.

D.7.11 *Periodical performance information report* - This function provides the ability for the NE to transmit in a period report, specified performance information to the OS.

D.7.12 *Performance information report* – This function provides the ability for the NE to transmit on an event basis, specified performance information to the OS.

This list is not exhaustive and requires further study.

D.8 *Alarm surveillance functions*

The functions of alarm surveillance are described in the “Alarm Surveillance” management service component (Annex C). Alarm surveillance is seen as a support service component for network traffic management.

D.9 *Traffic management control functions*

D.9.1 *Apply NTM control* – This function provides the ability for the OS to send a control instruction to the NE. The OS specifies all relevant information such as the associated trunk group and the action to take.

D.9.2 *Modify NTM control* – This function provides the ability for the OS to modify the parameters controlling the effects of a control. Permissible modifications could include such things as percentage of traffic re-routed, skipped, etc. or alternate trunks.

D.9.3 *Remove NTM control* – This function provides the ability for the OS to remove a control instruction from the NE.

D.9.4 *Apply a special recorded announcement* – This function provides the OS with the ability to instruct the NE to apply a pre-recorded special recorded announcement and to specify the type of traffic which is to be route to it.

D.9.5 *Modify a special recorded announcement* – This function provides the ability for the OS to access the NE to modify the type of traffic to be routed to a special recorded announcement.

D.9.6 *Remove a special recorded announcement* – This function provides the ability for the OS to instruct the NE to remove a special recorded announcement and restore normal traffic routing.

D.9.7 *Override automatic NTM control* – This function provides the ability for the OS to suppress a control autonomously set by the NE.

D.9.8 *Remove override of NTM control* – This function provides the ability for the OS to restore a control that has previously been overridden. The control will now affect the flow of traffic if currently triggered or as soon as it becomes triggered.

D.10 *Log functions*

D.10.1 *Allow/inhibit logging* – This function provides the ability for the OS to instruct the NE to allow/inhibit logging of log records.

D.11 *Administrative functions*

D.11.1 *Create/modify/remove a network traffic management schedule* – This function relates to the manipulation by the operator of the network traffic management schedules in the exchange or operations system which set the type of measurements to be made, the periodicity of the measurements, and the objects and entities for the management.

D.11.2 *Create/modify a traffic management data base* – This function relates to the establishment and updating of a data base in the exchange or operations system, of network statistics and information necessary to perform the network management function.

D.11.3 *Create/modify/remove thresholds for status reporting, data reporting and HTR determination* – This function involves the establishment and maintenance by the operator, of the values for the various thresholds in the exchange or operations system for data collection and reporting, and control activation.

D.11.4 *Create/modify/remove schedules for status data reporting* – This function relates to the establishment and maintenance by the operator, of the schedules in the exchange or operations system, for the reporting of status and network performance data.

D.11.5 *Request routing table information* – This function involves the reporting to the operator of routing table information which resides in the exchange or operations system, in response to an operator request.

D.11.6 *Request report schedules* – This function provides the OS with the ability to request the NE to send a specified current report schedule (network status, performance, traffic management) to the OS. NE responds with the specified schedule.

D.11.7 *Request threshold values* – This function provides the OS with the ability to request the NE to send a specified current threshold value (network status, performance, automatic control activation) to the OS. The NE responds with the specified threshold value.

D.11.8 *Set network status/performance information attributes* – This function provides the OS with the ability to direct the NE to set the parameters to collect the network status/performance information.

D.11.9 *Request network status/performance information attributes* – This function provides the OS with the ability to request the NE to report the current network status/performance information attributes. The NE responds with the current network status/performance information attributes.

D.11.10 *Create NTM control* – This function provides the ability for the OS to specify a control instruction in the NE. The OS specifies all relevant information such as the associated trunk group and the action to take. When defined, the control can be initially overridden or not. If overridden, the control will not affect traffic, even if triggered.

D.11.11 *Request NTM audit* – These functions allow the OS to poll for specific reference data from the NE. The OS specifies the specific data needed and the trunk, trunk group, controls, etc. for which the information is needed. The NE sends the requested information to the OS.

D.11.12 *Request NTM audit report* – This function provides the ability for the OS to poll the NE and receive a report containing various NTM administrative data (e.g. reference data, threshold settings, control status, measurements being generated, etc.).

D.11.13 *Request NTM change audit* – This function provides the ability for the OS to poll the NE and receive a report of all the recently changed audit data. The audit data are extracted from the changed log, and contains all changes that have occurred since the last change audit report.

D.11.14 *Request NTM history report* – This function allows the OS to request data from the NE concerning a previous period.

D.11.15 *Request NE clock* – This function provides the ability for the OS to obtain the current time at the NE.

D.11.16 *Create trigger* – This function provides the ability for the OS to define a trigger condition (threshold) that can activate one or more controls.

D.11.17 *Modify trigger* – This function provides the ability for the OS to alter the trigger condition (threshold) that is used to activate one or more controls.

D.11.18 *Remove trigger* – This function provides the ability for the OS to remove a trigger condition (threshold) that could have activated one or more controls.

D.11.19 *Define response related table entries* – The function provides the ability for the OS to specify information used in the administration of one or more controls (e.g. a list of hard-to-reach numbers). This function affects information that is not directly associated with the control itself.

D.11.20 *Modify response related table entries* – This function provides the ability for the OS to modify various information used in the administration of one or more controls. This function affects information not directly associated with the control itself.

D.11.21 *Remove response related table entries* – This function provides the ability for the OS to delete information used in the administration of one or more controls. This function affects information not directly associated with the control itself.

D.11.22 *Define NTM summary report generation schema* – This function provides the ability for the OS to initially define the information the NE includes in the NTM summary report. The NTM summary report generation schema specifies what measurements and objects are to be included in subsequent NTM summary reports.

D.11.23 *Request NTM summary report generation schema* – This function provides the ability for the OS to retrieve the information controlling what the NE includes in an NTM summary report.

D.11.24 *Modify NTM summary report generation schema* – This function provides the ability for the OS to alter the information controlling what the NE includes in an NTM summary report.

D.11.25 *Remove NTM summary report generation schema* – This function provides the ability for the OS to delete the information controlling what the NE includes in an NTM summary report. The summary report defined by the deleted NTM summary report generation schema will no longer be produced.

D.11.26 *Define NTM event report control* – This function provides the ability for the OS to initially define a set of criteria for restricting autonomous unscheduled NTM data. The NE uses these criteria to determine which events the OS should be notified of. Only autonomous unscheduled NTM data, meeting the specified conditions, are transmitted to the OS.

D.11.27 *Request NTM event report control* – This function provides the ability for the OS to retrieve the criteria for restricting the transmission of autonomous unscheduled NTM data.

D.11.28 *Modify NTM event report control* – This function provides the ability for the OS to alter the criteria for restricting the transmission of autonomous unscheduled NTM data.

D.11.29 *Remove NTM event report control* – This function provides the ability for the OS to delete the criteria used to restrict the transmission of autonomous unscheduled NTM data.

D.11.30 *Create audit generation schema* – This function provides the ability for the OS to initially define the information which the NE includes in an audit report. The audit generation schema specifies what audit information is to be included in subsequent audit reports.

D.11.31 *Request audit generation schema* – This function provides the ability for the OS to retrieve information controlling what the NE includes in an audit report.

D.11.32 *Modify audit generation schema* – The function provides the ability for the OS to alter the information controlling what the NE includes in an audit report.

D.11.33 *Remove audit generation schema* – This function provides the ability for the OS to delete the information controlling what the NE includes in an audit report.

D.11.34 *Condition logging* – This function provides the OS with the ability to instruct the NE to assign log attributes as specified by the OS.

D.11.35 *Request log condition* – This function provides the OS with the ability to request the NE to send the current assignment of specified log attributes. NE responds with the current assignment of the specified attributes.

D.11.36 *Create change log schema* – This function provides the ability for the OS to create a change log within the NE. The OS defines what information is to be maintained within the log and how the log is to behave (e.g. when the log is full).

D.11.37 *Request change log schema* – This function provides the ability for the OS to retrieve the criteria specifying what changes are to be included in the change log and how the log is to behave.

D.11.38 *Modify change log schema* – This function provides the ability for the OS to alter the criteria specifying what changes are to be included in the change log and how the log is to behave.

D.11.39 *Remove change log schema* – This function provides the ability for the OS to remove a change log within the NE.

D.12 *Glossary*

D.12.1 **Traffic management information**

The set of information produced in the NTM centre describing the network status and performance, the abnormal conditions detected, the problems identified, and the NTM controls.

D.12.2 **Traffic management data**

Information provided by the NE and used for the production of NTM parameters and for display on alerting devices.

D.12.3 **Traffic management indicator**

The set of standard signals to express distinct load conditions on the traffic resources of an NE.

D.12.4 **Traffic management parameters**

Information produced in the NTM centre, to be used for the production of abnormal condition reports and for display on alerting devices.

ANNEX E

(to Recommendation M.3200)

TMN management service "Common Channel Signalling Systems Management"

TIB A

Description of TIB A

This TMN management service covers all those aspects concerned with the management of CCSSs. In describing the process of managing a CCSS, it is necessary to take into account events and information outside of the sphere of this management service. An example of this may be the failure of a transmission system over which the signalling traffic is carried. This information will need to be taken into account to ensure efficient utilisation of the network.

To this end it will be necessary to have a network wide view of the availability of the signalling network and the signalling traffic loading. In some network situations, only information relating to a particular node and the nodes connected to it are known. Problems beyond this node, such as congestion, may add complications, if the node is used as a Signalling Transfer Point (STP). Therefore the network wide view should at least contain the following relevant information:

– configuration of the signalling network;

– the availability or non-availability of each signalling link set and its capacity;

– the current loading of each link set;

– indication of the initiation of internal flow control procedures.

– information contained in Recommendations Q.750 [11], Q.751 [12], Q.752 [13], Q.753 [14], and Q.754 [15].

The information gathered will be in the form of statistical measurements. These measurements will be gathered from within and from outside of the signalling system concerned. The type of measurements needed have been taken from Recommendation Q.791 [16]. Where appropriate additional information has been added.

CCSS management will also take into account planning and should make use of computer based tools. These tools could contain information such as:

- a map of the network containing all signalling points and STPs, signalling routes and their capacities;
- detection of signalling link sets requiring additional capacity;
- interconnection with transmission planning information to ensure the required diversity of transmission paths;
- etc.

The management system should provide the ability to manipulate signalling resources through a Human-Machine Interface (HMI). Some of the types of information that could be accessed/altered include:

- control signalling link states;
- introduce new routes;
- reporting of fault conditions;
- collection of statistics;
- change routes.

Components of service

E.1 *Planning*

- signalling links;
- signalling routing;
- signalling configuration;
- signalling dimensioning;
- transmission systems (relates to transmission planning).

E.2 *Maintenance*

- detection and correction of faults;
- verification of routing data.

E.3 *Performance*

- signalling load measurements;
- signalling congestion measurements;
- of controls.

E.4 *Provisioning*

- new signalling links;
- signalling transfer points.

TIB B

TMN management function list

(For further study.)

References

[1] CCITT Recommendation M.3020 *TMN interface specification methodology*.

[2] CCITT Recommendation M.3100 *Generic network information model*.

[3] CCITT Recommendation M.3400 *TMN management functions*.

[4] CCITT Recommendation E.412 *Network management controls*.

[5] CCITT Recommendation Q.500-Series *Digital local, combined, transit and international exchanges in integrated digital networks and mixed analogue-digital networks*.

[6] CCITT Recommendation Q.531[3)].

[7] CCITT Recommendation Q.512 *Exchange interfaces for subscriber access*.

[8] CCITT Recommendation Q.513 *Exchange interfaces for operations, administrations and maintenance*.

[9] CCITT Recommendation Q.521 *Exchange functions*.

[10] CCITT Recommendation Q.542 *Digital exchange design objectives – Operations and maintenance*.

[11] CCITT Recommendation Q.750 *Overview of Signalling System No. 7 management*.

[12] CCITT Recommendation Q.751 *Signalling System No. 7 managed objects*.

[13] CCITT Recommendation Q.752 *Signalling System No. 7 monitoring and measurements*.

[14] CCITT Recommendation Q.753 *Signalling System No. 7 management functions*.

[15] CCITT Recommendation Q.754 *Signalling System No. 7 management ASE definitions*.

[16] CCITT Recommendation Q.791 *Monitoring and measurements of Signalling System No. 7 network*.

[17] CCITT Recommendation Q.821 *Stage 2 and stage 3 description for the Q.3 interface*.

[18] CCITT Recommendation E.411 *International network management – Operational guidance*.

[19] CCITT Recommendation E.413 *International network management – Planning*.

[20] CCITT Recommendation Q.541 *Digital exchange design objectives – General*.

[21] CCITT Recommendation Z.337 *Network management administration*.

[22] CCITT Recommendation E.400-Series *Telephone network and ISDN. Quality of service, network management and traffic engineering*.

[23] CCITT Recommendation M.3010 *Principles for a telecommunication management network*.

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3) Presently at the stage of draft.