ETSI

ETSI
TECHNICAL
REPORT

ETR 047

September 1992

Source: ETSI TC-NA

Reference: DTR/NA-43304

ICS: 33.080

Key words: TMN, management

Network Aspects (NA);
Telecommunications Management Network (TMN)
Management services

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Contents

		5.10.1.1	Extent of management from TMN of IN	52
		5.10.1.2	Components of service	53
	5.10.2	Application function list		54
5.11	Common channel signalling systems management			55
	5.11.1	Introduction		55
		5.11.1.1	TIB A	55
		5.11.1.2	Components of service	56
	5.11.2	TIB A: TMN management service function list		56

Annex A: Definitions of tariff and charging 59

A.1   Tariff administration 59

A.2   Charging administrations 59

A.3   Charging function 59

A.4   Tariffing 59

A.5   Pricing 59

A.6   Billing 59

A.7   Accounting 60

History 61

Foreword

ETSI Technical Reports (ETRs) are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim-European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or I-ETS.

This ETR has been produced by the Network Aspects (NA) Technical Committee of the European Telecommunications Standards Institute (ETSI).

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1 Scope

This ETSI Technical Report (ETR) provides a description of the following Telecommunication Management Network (TMN) management services:

- Management of Transmission Paths, Circuits between Exchanges and associated equipment (MTPCE);

- Management of Customer Access (MCA);

- switching management;

- Tariff and Charging Administration (TCA);

- traffic management;

- customer administration;

- routing and digit analysis administration;

- Staff Work Scheduling (SWS);

- materials management;

- Common Channel Signalling Systems (CCSSs);

- Intelligent Networks (INs).

It is emphasised that the main objective of this ETR is the analysis of each management service with a view to defining the objects referenced by it. Therefore this ETR is not intended as a specification of the listed management services.

2 References

The following references are used within this ETR.

[1]   CCITT Recommendation E.411: "International network management - Operational guidance".

[2]   CCITT Recommendation E.412: "Network Management controls".

[3]   CCITT Recommendation E.413: "International network management - Planning".

[4]   CCITT Recommendation I.430: "Basic user-network interface - Layer 1 specification".

[5]   CCITT Recommendation M.20: "Maintenance philosophy for telecommunication networks".

[6]   CCITT Recommendation M.251: "Maintenance functions to be implemented in CCITT-MML".

[7]   CCITT Recommendation M.30: "Principles for a telecommunications management network".

[8]   CCITT Recommendation Q.500: "Digital, local, combined transit and international exchanges, introduction and field of application".

[9]   CCITT Recommendation Q.512: "Exchange interfaces for subscriber access".

[10]   CCITT Recommendation Q.513: "Exchange interfaces for operations, administration and maintenance".

[11]   CCITT Recommendation Q.521: "Exchange functions".

[12]   CCITT Recommendation Q.541: "Digital exchange design objectives - General".

[13]   CCITT Recommendation Q.542: "Digital exchange design objectives - Operations and maintenance".

[14]   CCITT Recommendation Q.791: "Monitoring and measurements for Signalling System No.7 networks".

[15]   CCITT Recommendation Z.337: "Network management administration".

[16]   DI/NA-43307: "Generic managed objects seen at TMN interfaces".

[17]   DTR/NA-43305: "Network Aspects (NA); Phase 1 support object class specification".

[18]   ETR 048: "Network Aspects (NA); Telecommunications Management Network (TMN) Management services prose descriptions".

[19]   T1.210-199x: "Principles of functions, architecture and protocol for Telecommunication Management Network (TMN) interfaces".

3   Abbreviations and terminology

3.1   Abbreviations

For the purposes of this ETR the following abbreviations apply.

CCF   Connection call Control Function

CCSS   Common Channel Signalling System

CS1   Capability Set 1

DOC   Dynamic Overflow Control

GoS   Grade of Service

HMI   Human-Machine Interface

HTR   Hard To Reach

IN   Intelligent Network

ISDN   Integrated Services Digital Network

MCA   Management of Customer Access

ME   Maintenance Entity

MTP   Message Transfer Part

MTPCE	Management of Transmission Paths, Circuits between Exchanges and associated equipment
NE	Network Element
NT	Network Termination
NTM	Network Traffic Management
OMC	Operations and Maintenance Centre
OS	Operation System
PM	Performance Monitoring
POTS	Plain Ordinary Telephone Service
PSDN	Packet Switched Data Network
PSTN	Public Switched Telephone Network
RLU	Re-Loadable Units
RPO	Remote Processor Outage
RPU	Replaceable Units
SCF	Service Control Function
SDF	Specialised Database Function
SIB	Service Independent building Block
SCEF	Service Creation Environment Function
SMAF	Service Management Access Function
SMF	Service Management Function
SNM	Switching Network Management
SPC	Stored Program Control
SRF	Specialised Resource Function
SSF	Service Switching Function
SWS	Staff Work Scheduling
TCA	Tariff and Charging Administration
TM	Traffic Management

Many of the management service documents refer to CCITT Recommendations. The inclusion of these references is valuable where additional information may be required.

3.2   Terminology

A number of terms and acronyms are used in the definitions of the management services contained within this ETR. This Clause gives a brief explanation of these terms and, where possible, makes reference to the appropriate documents that expand on the definitions given here.

TMN management service: an area of management activity which provides for the support of an aspect of operations administration or maintenance of the network being managed.

Management function: a management function is the smallest part of the management service as perceived by the user of the service. In reality it will consist of a sequenced set of actions on a defined managed object or objects.

ME (Maintenance Entity): the different equipment of a telecommunications network constituting the Maintenance Entities (MEs) are interconnected at consecutive and easily identifiable interface points, at which the interface conditions defined for this equipment apply and which possess the means of detecting maintenance events and failures (CCITT Recommendation M.20 [5]).

NE (Network Element): telecommunication equipment (groups or parts) within the telecommunications network which performs Network Element (NE) functions, i.e. provides support and/or service to the subscriber. A NE communicates with the TMN over one or more standard interfaces for the purpose of being monitored and/or controlled.

NT (Network Termination): the functional group on the user side of a user-network interface (CCITT Recommendation I.430 [4]).

OS (Operation System): computer systems, micro, mini or intelligent work stations, which serve operations functions or collect data for the purpose of management.

TMN (Telecommunications Management Network): a TMN comprises principles, architectures, functions, data, communication services and protocols for the exchange and processing of management data and functions for telecommunications networks.

4   Requirements capture

The TMN management services are defined as areas of management activities that provide for the support of aspects of planning, operating and maintaining the network being managed, always described from the user perception of management requirements. Each TMN management service has been described using Task 0 and Task 1 of the TMN methodology described in ETR 048 [18]. The main goal of this methodology is to provide the description of the object models and interfaces requirements supporting the management activities.

Task 0 provides the prose description of the TMN management service itself and of the TMN management service components. These are the constituent parts of the TMN management service, triggering the actions to be performed on the management network. The TMN management service components correspond to the parts of the TMN management service that are visible to the user.

Task 1 provides the list of TMN management functions. These are the management capabilities supporting the TMN management service, as perceived by a user of such a service, and are presented as a sequenced set of actions on a defined managed object, or objects. The reader should note that when defining a management service it is advisable to take into account all available material that exists within current CCITT and ISO telecommunications standards. This information should ensure that a more thorough description is made of the management service under definition. An aid in the specification of management services may be to use a tool called "management services template". The following text describes the tool and its use.

4.1 Template description

In specifying a management service 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 management services 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 to all possible functional areas of management, e.g. performance management, fault management, accounting management, etc. A pictorial representation of the template is given in figure 1.

The template is two-dimensional, the first dimension being the logical representation of an administrations management hierarchy and the second being a list of those 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 management service 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 management service specification.

4.2 Method of use

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

1) specify the management service;

2) work consistently through each box of the template. The output from each of the boxes will be a list of the management service components which have been identified;

3) expand each component into its respective functions.

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 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.

It is not the intention of this ETR to identify managed objects, however, it is envisaged that this ETR, along with other ETRs on subjects such as the generic network model, may be used to identify those objects that will be under the control of a manager. To this end each of the management services listed will have a specific network diagram within the text. These diagrams will give a pictorial representation of the specific area of the network that the management service is referring to. The use of the diagram along with the text will enable the identification of managed objects that need to be addressed for that particular service. Where diagrams already exist within CCITT or ISO Recommendations etc., they should be utilised.

In the process of identifying management services it will become apparent that some management services will address information that will flow across the Q3 interface, and some that refer to messages that do not flow across the Q3 interface. As an aid to the reader the subclauses of the document that refer to the management services are split into two subclauses, one Q3 and one non-Q3.

Another point worth noting is the inter-relationship between management services. Because each management service relates to one particular part of the telecommunications network, the user may find that utilisation of one service may encroach on areas of another (see figure 3). A more detailed explanation of this can be found in subclause 5.3.

The overall structure of this ETR also comprises a clause with references to other recommendations (ETSI, CCITT, ISO...) and an explanation of terms and acronyms used.

This ETR should be used in conjunction with three other documents:

- ETR 048 [18], which gives a description of the 20 management services identified by ETSI;

- DTR/NA-43305 [17];

- DI/NA-43307 [16].

Functional Areas \ Layer	a Fault	b Configuration	c Performance	d Security	e Accounting	f Others *
1 Business Management						
2 Service Management						
3 Network Management						
4 Element Management						

* Others: More functional areas could be added and these may be: Design/Planning, Provision, Forecast, Monitor, etc.

Figure 1: TMN management services template

ACCOUNTING

1)	Charged units
2)	Service subscribed to
3)	Out of service time
4)	Billing arrangements
5)	...
6)	...

Service Management

Functions of:

1)	Charged units	2)	Service subscribed to	3)	....
a)	TMN requests NE to send currently-stored units	a)	TMN directs NE to allow the addition of service (x)	a)	...
b)	NE responds	b)	etc.	b)	...
c)		c)		c)	
.		.		.	
.		.		.	
n)	...	n)	...	n)	...

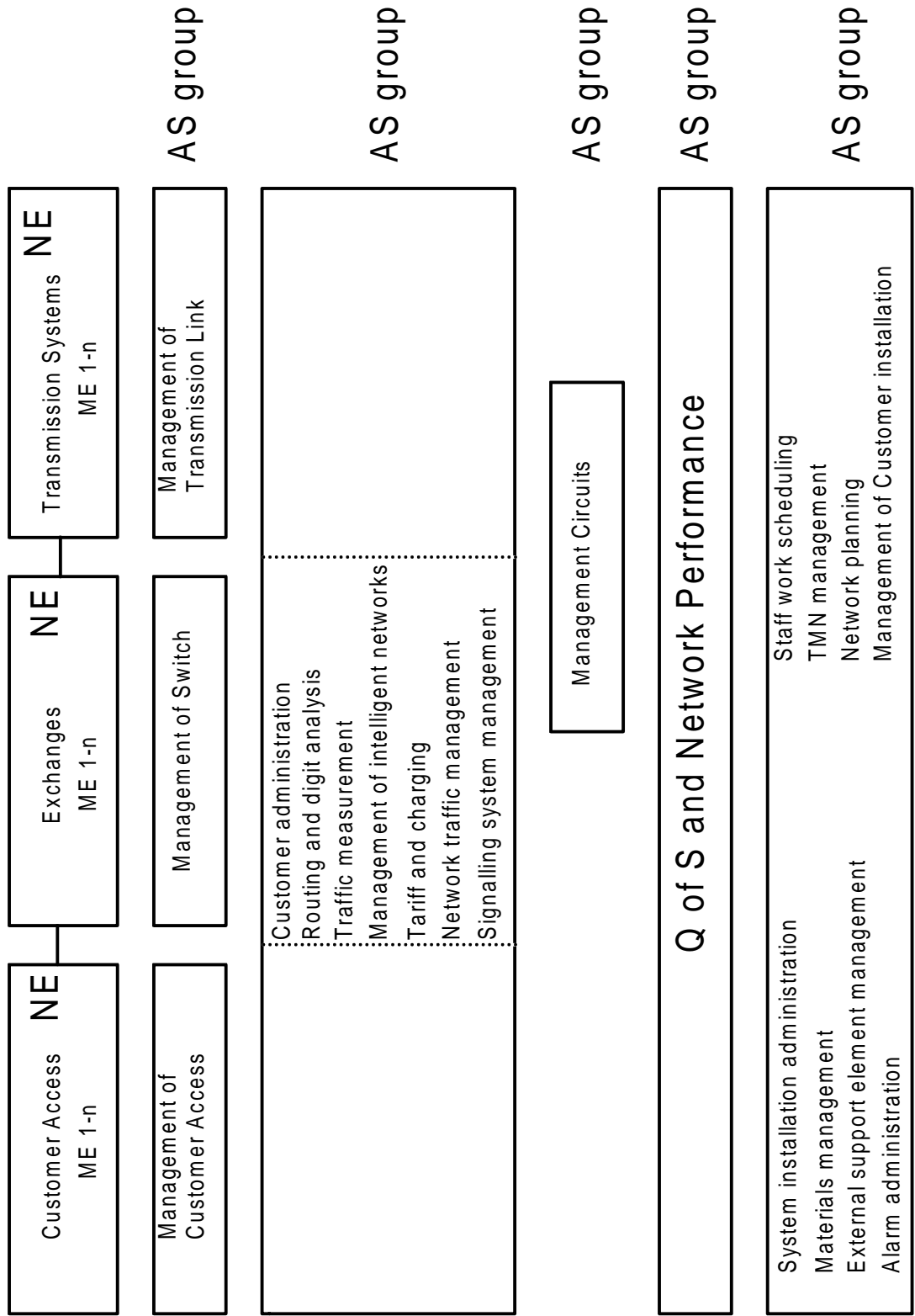**Figure 2: Example of the expansion of one box from figure 1**

NE Transmission Systems ME 1-n

NE Exchanges ME 1-n

NE Customer Access ME 1-n

AS group — Management of Transmission Link

AS group — Management of Switch

AS group — Management of Customer Access

AS group:
Customer administration
Routing and digit analysis
Traffic measurement
Management of intelligent networks
Tariff and charging
Network traffic management
Signalling system management

AS group — Management Circuits

AS group — Q of S and Network Performance

AS group:
Staff work scheduling
TMN management
Network planning
Management of Customer installation
System installation administration
Materials management
External support element management
Alarm administration

Figure 3: TMN application services

5   TMN management services

In some instances the management service documents contain annexes. These are included where further definitions are considered necessary.

Each management function list has an abbreviation, followed by a set of numbers down the right hand side of the page. These abbreviations refer to the management service component that relates to those particular functions.

5.1   Management of transmission networks, circuits between exchanges and associated equipment

5.1.1   TIB A

Description

The following description is split into a number of parts to make the definition easier to understand.

Management of transport networks covers all those functions necessary to bring into service and keep in service trails, including monitoring the performance of the trail. The trail is characterised 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 Synchronous Digital Hierarchy (SDH), a trail could be defined as a lower order path or a higher order path. Connection functions could be done by a digital multiplex or a digital cross-connect;

- in Pleisochronous Digital Hierarchy (PDH), a trail could be defined as a path. Connection functions could be done by a multiplex or a line system;

- in Asynchronous Transfer Mode (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 CCITT draft Recommendation G.tna: "Generic functional architecture of transport networks". Management of circuits between exchanges and associated equipment covers all those functions necessary to bring into service, and keep in service, analogue and digital circuits between exchanges. This may also include recorded information services and other circuit related equipments such as echo cancellers.

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 circuit is defined as a circuit between two analogue telephone exchanges and is provided with digital transmission throughout. The circuit is terminated by its two access points.

A digital 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 only be obtained via the digital switches.

A mixed analogue/digital 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.

Management of transmission paths covers all those functions necessary to bring into service and to keep in service transmission paths, including monitoring and performance of the paths. A transmission path is defined as the whole means of transmitting and receiving a transmission signal of specified rate between two distribution frames (or equivalent) at which terminal equipment or switches will be connected. Terminal equipment are those at which signals at the specified bit rate originate or terminate and may include multiplexing and de-multiplexing. The transmission path may include one or more transmission sections. It also includes all equipment associated with the paths e.g. regenerators, line terminations and cross connects.

5.1.2 Components of service

Performance measuring: involves the continuous collection of data concerning the performance of the NEs:

- observing and supervising paths;

- continuous or periodic checking of function.

Bringing into service: involves testing the functions of NEs to ensure they are within the relevant specification and changing the state of the NE to bring it into service:

- testing;

- initiate unblocking.

Failure detection: involves the collection of data concerning the degradation and failure of NEs without the customers awareness:

- observing and supervising paths;

- observing and supervising circuits and associated equipment; [1]

- continuous or periodic checking of function.

System protection: involves the transmission of signals to NEs to change their state or to initiate protection switching with minimal degradation of service:

- initiate blocking;

- initiate protection switching.

Failure information: involves the transmission of alarms and the results of automatic diagnostic tests from the NE to the TMN:

- alarm surveillance;

- minimum diagnostic tests.

Fault localisation: involves the receipt of failure information from the NE, the initiation of additional localisation techniques and the receipt of the results from them:

- testing.

Fault correction: involves the replacement of the faulty part of a NE and, if possible, the repair of the faulty part by a specialised repair centre.

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[1] Failure detection in this application service component may mean the alarm monitoring of a rack of amplifiers or equalizers associated with subscribers private wires or other associated equipment involved with circuits between exchanges.

Verification: involves the testing of the previously faulty NE to ensure its correct functioning before bringing it back into service:

- testing.

Restoration: involves changing the state of a NE to bring it back into service:

- unblocking;

- restore protection switching.

Configure terminating equipment: involves changing the configuration of managed NEs.

5.1.3 TIB A: TMN management services function list

Request PM data: TMN requests the NE to send current Performance Monitoring (PM) data.

MTPCE 1,3 [2](3.1.1)

PM data report: NE sends performance data to the TMN. It may be generated routinely by the NE, sent upon demand by the TMN or by exception when a parameter threshold has been exceeded.

Schedule PM data report: TMN directs NE to establish a schedule for the reporting of PM data.

Request PM data report schedule: TMN directs NE to send the current PM data reporting schedule; NE responds with the schedule.

Start/stop PM data: TMN directs the NE to start or stop the collection of PM data.

Initialise PM data: TMN directs NE to reset storage registers for PM data.

Set service thresholds: TMN directs NE to set performance thresholds for the specified entity.

[2](3.3.1.1)

Report PM analysis.

Request PM analysis.

Connect test access: TMN directs NE to provide a test connection to the link access point of the links to be tested.

MTPCE 2,6,8 [2](3.2.3.1.1)

Disconnect test access: TMN directs NE to drop access to the link under test and return the link to its previous state.

Request test result: TMN requests NE to report intermediate or final results from a measurement.

Test result report: NE send the results of a test to TMN.

Change port restore: TMN directs NE to clear all test conditions and restore the link to a monitor state.

Connect monitor access: TMN directs NE to provide a monitor connection to the link under test and monitor in either direction.

[2](3.2.3.1.2)

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[2]   This numbering scheme appertains to references within CCITT Recommendation M.30 [7].

Change monitor level: the TMN directs NE to change the level of the monitor connection.

Change monitor filter: TMN directs NE to remove or insert the single frequency notch filter placed in the monitor connection.

Disconnect monitor: TMN directs NE to remove any monitor or talk conditions established to the link under test.

Change split and supervision: TMN directs NE to set up metallic test access splitting of the circuit and supervise in both directions for both AC and DC supervision.

Request supervision status: TMN requests NE to send an analysis of the current signalling state of the circuit.

Supervision status report: NE reports the current signalling state of a circuit under test to the TMN.

Start/stop routine tests (e.g. ATME).

Schedule routine tests.

Report routine test schedule.

Connect monitor state: TMN directs NE to establish a monitor state without the need to re-access the link. This function will remove or reset any previous state or condition.

Connect measuring equipment: TMN directs NE to connect measuring equipment to a particular circuit.

Disconnect measuring equipment: TMN directs NE to disconnect previously connected measuring equipment.

Apply loopback: TMN directs the NE to provide a loopback on the circuit under test.

Change latching loopback: TMN splits the circuit under test and changes the operate, release functions of the NE latching loopback devices.

Measure link characteristic: TMN directs NE to measure a link characteristic.

Apply test signals: TMN directs NE to send a test signal on the link.

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

Stop measurement: TMN directs NE to terminate continuous or repeating type measurements.

Report maintenance procedure: TMN prompts user with best course of action to follow.

Request status: TMN requests NE to send current status information.

Status report: NE reports to TMN the value of a monitored parameter. It may be sent on demand by TMN or on a scheduled basis.

Operate/release automatic restoration: TMN directs NE to switch a specified line or equipment to the redundant unit, or release it from the redundant unit. For an M+N system, service is placed on the redundant unit and taken off of the working unit. For a duplex system the main unit becomes the standby and the standby becomes the main unit.

Create restoration plan: TMN directs NE to store a particular restoration plan, which will indicate to the NE where to route faulty paths and which restoration paths to continuously monitor so that indication can be sent to the TMN to notify it that the proposed restoration path is faulty and another should be provided.

Change restoration plan: TMN directs NE to change its stored restoration plan, if, for instance, the proposed route is faulty or has been used to route traffic.

Delete restoration plan: TMN directs NE to delete restoration plan in readiness to receive a new plan.

Request restoration plan: NE requests TMN to send a proposed restoration plan.

Set service state: TMN directs NE to place the specified entity in one of the following states; in service (available for use), out of service (unavailable for use), standby (not faulty but not performing normal function) and reserved.

[2](3.3.1.1)

Request configuration: TMN requests that the NE report the current configuration of each entity.

MTPCE
4,9,6,10

Report configuration: for each entity, NE reports status, capacity of the entity, optional parameters, type of entity (in sufficient detail for TMN identification) and the version and revision of the version.

Condition alarm: TMN directs NE to assign alarm attributes, modes and thresholds.

MTPCE 1,5
[2](3.2.1)

Request alarm: TMN request NE to send current alarm information.

MTPCE 5

Alarm report: NE notifies TMN of alarm information; it may be sent automatically on occurrence or on demand by TMN.

Request condition: TMN requests NE to report the current assignment of alarm attributes, modes and thresholds; NE responds with the assignments.

Allow/inhibit alarms: TMN directs NE to allow/inhibit either local audible/visual alarms or remote alarms.

Alarm cut-off: TMN directs NE to reset designated audible alarms.

Update alarm history: TMN requests NE to add further information to its alarm history store.

Request alarm history: TMN requests NE to send its currently stored alarm history.

Request alarm analysis: TMN requests NE to send its alarm analysis.

Report alarm analysis: NE reports alarm analysis to the TMN.

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[2]   This numbering scheme appertains to references within CCITT Recommendation M.30 [7].

Set alarm filter: TMN directs NE to set alarm filter; this may take the form of indicating to the NE which alarms to ignore or where to route certain types of alarm.

Request alarm filter: TMN requests NE to send the data of its stored alarm filter information.

Update fault history: TMN directs NE to update its fault history.

Request fault history (attributes should include supplier information): TMN requests NE to send the results of a diagnostic sequence.

Request diagnostic data: TMN requests NE to send the results of a diagnostic sequence. [2](3.2.2)

Start diagnostic process: TMN directs NE to start the sequence of previously programmed diagnostics.

Stop diagnostic in progress: TMN directs NE to stop a particular diagnostic procedure in progress.

Diagnostic report: NE reports the results of a diagnostic sequence to the TMN. It may be used in conjunction with the request and stop functions and has applications where it may be necessary or desirable to repeat diagnostic tests for a period of time to "catch" a failure.

Schedule diagnostic: TMN directs NE to establish a routine schedule for the initiation of a diagnostic.

Request diagnostic schedule: TMN requests NE to report the current schedule of diagnostics.

Diagnostic schedule report: NE sends the current schedule of diagnostics.

Request assignments: TMN requests that NE report the identity of each assigned entity. The request may be for a specified entity or for all equipped entity or for a specified entity. MTPCE 6,10 (3.3.1.1)

Grow: TMN notifies NE of the presence of a newly installed entity. MTPCE 10

Prune: TMN notifies NE of the disconnection of an entity.

Rearrange: TMN instructs NE to change the assignment of connected equipments.

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[2]   This numbering scheme appertains to references within CCITT Recommendation M.30 [7].

5.2 Management of customer access

TMN References

The descriptions of the management functions are taken mostly from CCITT Recommendation M.30 [7]. Some of the functions have been modified. The numbering of the functions in that Recommendation have been retained for the time being for ease of reference. The un-numbered functions are additional functions found in CCITT Recommendation M.30 [7].

5.2.1 TIB A

Description

Management of Customer Access (MCA) 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 narrowband, 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 just copper wires and network terminating equipment. It may, however, 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.

5.2.1.1 Components of service

Performance monitoring: involves the continuous collection of data concerning the performance of the NE:

- observing or supervising customers line (CCITT Recommendation M.251 [6]);

- continuous or periodic checking of functions (CCITT Recommendation M.20 [5]).

Failure detection: involves the collection of data concerning the degradation and failure of NEs without the customer's awareness:

- observing or supervising customers line (CCITT Recommendation M.251 [6]);

- continuous or periodic checking of functions (CCITT Recommendation M.20 [5]).

System protection: involves the transmission of signals to NEs to initialise "out of service" or "in testing condition" with minimal degradation of service:

- initiate protection switching;

- initiate blocking.

Failure information: involves the transmission of alarm and diagnostic information between the NE and the TMN:

- alarm surveillance;

- minimum diagnostic tests.

Failure localisation: involves the receipt of failure information from the failed NE and information received from additional fault localisation techniques:

- tests and measurements.

Fault correction: involves the replacement of a faulty ME with a working replacement and the repair of the faulty NE by a specialised repair centre.

Verification: involves the testing of the replaced NE before bringing back into service:

- tests and measurements.

Restoration: repaired NEs are restored to service; blocked NEs are de-blocked and changeover to spare may be terminated:

- recover protection switching;

- unblocking.

Configuration: involves the configuration of network managed NEs:

- configure Network Termination (NT) optical Telephony over Passive Optical Networks (TPON);

- configure access network Flexible Access System (FAS).

5.2.2 TIB A application function list

Request PM data: TMN requests the NE to send current PM data.   MCA 1, 2

PM data report: NE sends performance data to TMN. It may be generated routinely by the NE, sent upon demand by the TMN or by exception when a parameter threshold has been exceeded.   MCA 1, 2

Schedule data PM report: TMN directs NE to establish a schedule for the reporting of PM data.   MCA 1, 2

Request PM data report schedule: TMN directs NE to send the current PM data reporting schedule; NE responds with the schedule.   MCA 1, 2

Start/stop PM data: TMN directs NE to start or stop the collection of PM data.   MCA 1, 2

Initialise PM data: TMN directs NE to reset storage registers for PM data.   MCA 1, 2

Request status: TMN request NE to send the current status information.   MCA 7, 8

Status report: NE reports to TMN the value of a monitored parameter. It may be sent on demand by the TMN or on a scheduled basis.   MCA 3, 8

Operator/release automatic restoration: TMN directs NE to switch a specified line or equipment to the redundant unit or release it from the redundant unit. For an M&N system, service is replaced on the redundant unit and taken off the working unit. For a duplex system the main unit becomes standby and the standby becomes the main unit.   MCA 3, 8

Set service state: TMN directs NE to place the specified entity in one of the following states; in service (available for use), standby (not for use), out of service (unavailable for use), standby (not faulty but not performing normal function) and reserved.   MCA 3, 8, 9

Request alarm: TMN requests NE to send current alarm information.   MCA 4

Alarm report: NE notifies TMN of alarm information. It may be sent automatically on occurrence or on demand by the TMN.   MCA 4

Condition alarm: TMN directs NE to assign alarm attributes, modes and thresholds.   MCA 4

Request condition: TMN requests NE to report the current assignment of alarm attributes, modes and thresholds; NE responds with the assignments.   MCA 4

Allow/inhibit alarms: TMN directs NE to allow/inhibit either local audible/visual alarms or remote alarms.   MCA 4

Alarm cut-off: TMN directs NE to reset designated audible alarms.   MCA 4

Request diagnostic data: TMN requests NE to send the results of a diagnostic sequence.   MCA 4

Stop diagnostic in progress: TMN directs NE to stop a particular diagnostic procedure in progress.   MCA 4

Diagnostic report: NE reports the results of a diagnostic sequence to TMN. It may be used in conjunction with the request and stop functions and has applications where it may be necessary or desirable to repeat diagnostic tests for a period of time to "catch" a failure.   MCA 4

Schedule diagnostic: TMN directs NE to establish a routine schedule for the initiation of a diagnostic.   MCA 4

Request diagnostic schedule: TMN directs NE to report the current schedule of diagnostics.   MCA 4

Diagnostic schedule report: NE sends the current schedule of diagnostics to TMN.   MCA 4

Measure electrical and optical circuit characteristics: TMN directs NE to measure a circuit characteristic including, but not restricted to; voltage, current, optical laser power readings, tip-ring-ground capacitance and resistance, noise tone and out-pulsing signals.   MCA 5, 7

Apply test signals: TMN directs NE to send a test signal on the circuit. Examples are out-pulsing and ringing signals.   MCA 5, 7

Remove test signal: TMN directs NE to remove the test signal sent by the apply function.   MCA 5, 7

Stop measurement: TMN directs NE to terminate continuous or repeating type measurements.   MCA 5, 7

Assign: TMN notifies NE that a previously unequipped entity is now equipped.   MCA 9

Delete: TMN notifies NE that a previously equipped entity is no longer equipped.   MCA 9

Add/drop: TMN directs NE to insert or remove a channel from the compliment of through channels.   MCA 9

Cross-connect: TMN directs NE to interconnect two specified channels operating at the same rate.	MCA 9
Disconnect: TMN directs NE to remove the interconnection between two specified channels.	MCA 9

5.3   Switching management

5.3.1   TIB A

5.3.1.1   Description

The NE exchange includes functions as specified in CCITT Recommendation Q.500 [8]. One function is switching. The scope of this text is to describe the management needed for switching. Management of other functions included in the NE exchange, will be described in separate texts. This text is based on CCITT Recommendations Q.500 [8] which concern 64 k/bits. However, the same general principles will be used for higher level switches. The NE may consist of one or more MEs. The MEs can be placed at different locations. One ME provides a Q3 interface, which is common for all MEs 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 into a number of Re-Loadable Units (RLUs), see figure 4.

5.3.1.2   Definition

Figure 1 is intended to give an overview of the management services which are necessary to be included. The management service "switching management" will cover the functions for switching included in the NE exchange. The design objectives and interfaces for exchanges are specified in CCITT Recommendation Q.500 [8]. CCITT Recommendation Q.500 [8] Recommendations will be used as a base for the work with management services which concern exchanges. Figure 1 shows a proposed allocation of the management services and the NEs.

Management service group 1: these management services will take care of hardware and software included in the NEs.

Management service group 2: management services which concern functions included in the NE exchange.

Management service group 3: this management service partly concerns exchange and partly transmission systems.

Management service group 4: this management service concerns all NEs in the network.

Management service group 5: the management services in groups 1 - 4 will be used as a basis for the Q3 interface when group 5 is included in Operation System (OS) and independent of the Q3 interface.

5.3.1.3 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 CCITT Recommendation Q.500 [8]. The NE exchange may consist of one or more MEs. Every ME will be provided with functions for management. However, the reports from the NE to OS via the Q3 interface will include identification of faulty RPU's and RLUs independent of where the concerned RPUs and RLUs are placed in the NE. The geographic address of the ME is stored in the OS. The number of MEs in the NE depends on the system design and the population distribution in the area.

The management service will include functions for:

- performance management;

- fault (maintenance) management;

- configuration management.

The management functions in the NE include supervision, which works continuously and generates an alarm if a fault occurs which leads to degeneration of the 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 will be sent from the NE to the OS:

a) degeneration of the performance:

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

b) faulty objects:

   an object can be an NE, ME, 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:

   - standard;

   - system unique.

   Test of the objects shall be possible from the OS.

CCITT Recommendations: the NEs which will be connected to the OS via Q3 are specified in CCITT Recommendations. The following CCITT Recommendations will be used as a basis for the work on the modelling of the management service "switching management", Q.512 [9], Q.513 [10], Q.521 [11] and Q.542 [13].
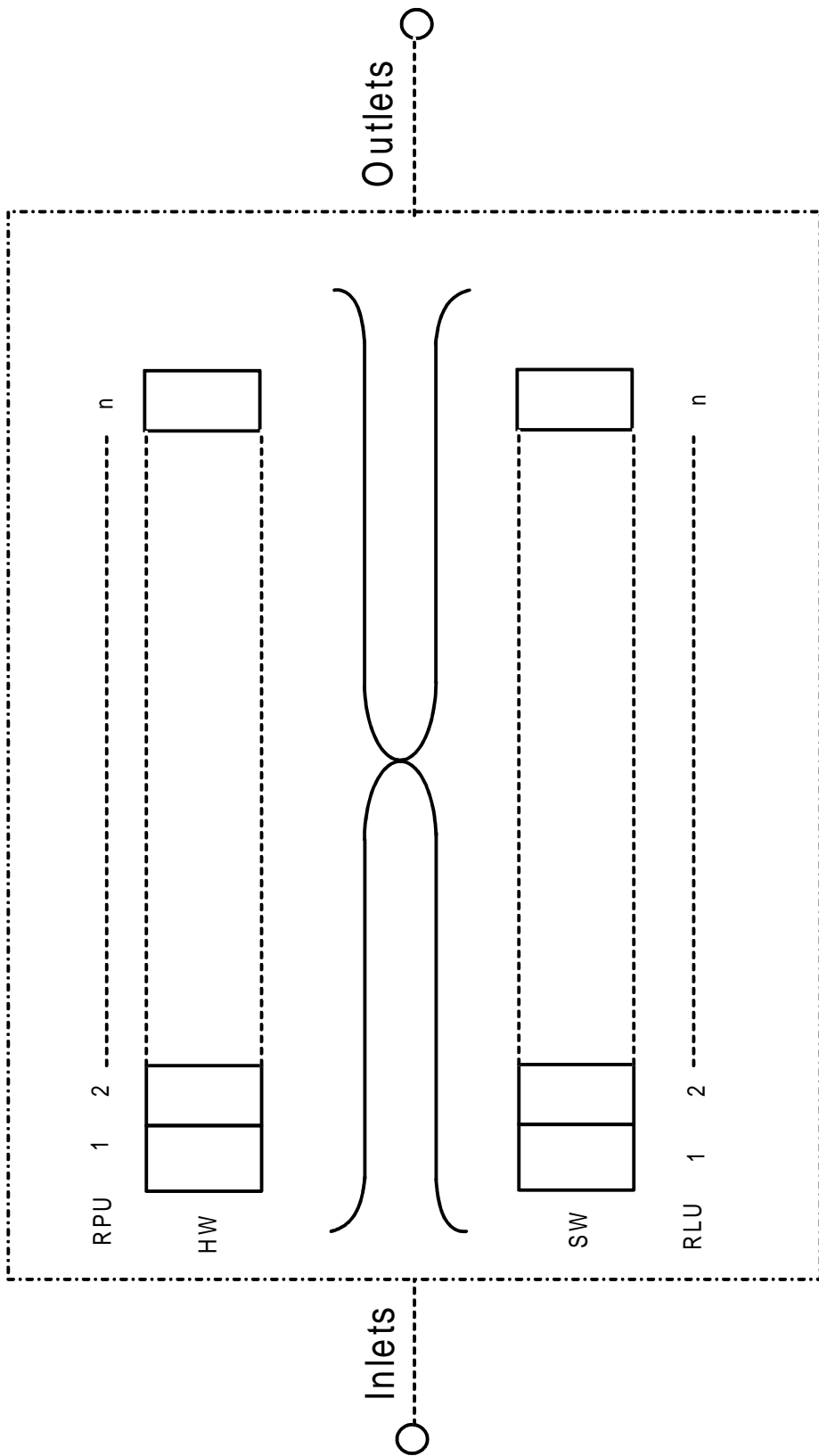
Figure 4: TMN management services - switch

5.3.1.4 Components of service

Performance measuring:

- observing and supervising associated MEs and NEs;

- continuous and periodic checking of functions for analysis of Grade of Service (GoS) and for static reports.

Maintenance service components:

- bringing into service;

- set parameters needed;

- set threshold limits needed;

- test call over inlets and outlets.

Failure detection:

- supervising of switch functions;

- threshold limit alarm.

System protection:

- blocking of faulty RPU or RLU;

- blocking of faulty switch level within an ME.

Failure information:

- alarm surveillance.

Fault location:

- test call;

- looping.

Fault correction:

- ME restoration or change of RPU or RLU.

Configuration components:

- configuration of switch;

- set inlets and outlets parameters;

- set threshold limits;

- set alarm levels for faulty operation;

- set alarm levels for threshold limit overrides.

5.3.2   TIB A management function list

> NOTE: SNM = Switching Network Management.

Performance management

Request PM data: TMN requests the NE to send current PM data.   SNM 1

PM data report: NE sends performance data to TMN. It may be generated routinely by the NE, sent upon demand by the OS or by exception when a parameter threshold has been exceeded.

Schedule PM data report: TMN directs NE to establish a schedule for the reporting of PM data.

Request PM data report schedule: TMN directs NE to send the current PM data reporting schedule; NE responds with the schedule.

Start/stop PM data: TMN directs NE to start / stop the PM data.

Initialise PM data: TMN directs NE to reset storage registers for PM data.

Set service thresholds: TMN directs NE to set performance thresholds for the specified function.

Report PM analysis.

Request PM analysis.

Fault management

Testing

Perform test in the NE: TMN directs NE to provide a test.

Interruption of test: TMN directs NE to stop the test in the ME under test.

Request test result: TMN requests NE to report intermediate or final results from the test.

Test result report: NE sends the results of a test to the TMN.

Test interruption: TMN directs NE to clear all test conditions and restore the NE to a monitor state.

Connect Monitor access: TMN directs NE to provide monitor connection to the ME under test.

Disconnect monitor: TMN directs NE to remove monitor state.

Connect monitor state: TMN directs NE to establish a monitor state.

Alarm surveillance

Condition alarm: TMN directs NE to assign attributes, modes and thresholds.   SNM 5

Request alarm: TMN requests NE to send current alarm information.

Alarm report: NE notifies TMN of alarm information. It may be sent automatically on occurrence or on demand by the OS.

Request condition: TMN requests NE to report the current assignment of alarm attributes, modes and thresholds; NE responds with the assignment.

Allow/inhibit alarms: TMN directs NE to allow/inhibit alarm reports.

Alarm cut-off: TMN directs NE to reset designated audible alarms.

Failure localisation - start diagnostic process

Request diagnostic data: TMN requests NE to send the results of a diagnostic sequence.

SNM 6

Stop diagnostic in progress: TMN directs NE to stop a particular diagnostic procedure in progress.

Diagnostic report: NE reports the results of a diagnostic sequence to TMN. It may be used in conjunction with the request and stop functions and has applications where it may be necessary or desirable to repeat diagnostic tests for a period of time to "catch" a failure.

Schedule diagnostic: TMN directs NE to establish a routine schedule for the initiation of a diagnostic.

Request diagnostic schedule: TMN requests NE to report the current schedule of diagnostics.

Diagnostic schedule report: NE sends the current schedule of diagnostics to TMN.

Request assignments: TMN requests that NE report the identity of each assigned RPU and RLU. The request may be for a specified RPU or RLU, or for all equipped entities.

Request supervision status: TMN requests NE to send an analysis of the current state of the ME.

Supervision status report: NE reports the current status to TMN.

Request status: TMN requests NE to send the current status information of RPU concerned.

Status report: NE reports to the TMN a value of a monitored parameter. It may be sent on demand or on a scheduled basis.

Configuration - report NE configuration

Request configuration: TMN requests that NE sends the current configuration of each entity.

Request threshold and pre-threshold limits: TMN requests NE to send the current threshold and pre-threshold limits.

SNM 2

Assign synchronisation value: TMN directs NE to assign current synchronisation value.

Change parameters: TMN requests NE to change all or part of ME parameters.

Change threshold or pre-threshold limits: TMN requests NE to change threshold and/or pre-threshold limits.

Change alarm class information: TMN requests NE to change alarm class information.

Report of NE configuration

Report status: for each ME, the NE reports status, capacity of the entity, optional parameters, type of entity and the version and the revision status.

5.4 Tariff and charging administration

Definitions are given in Annex A.

5.4.1 TIB A

Description

The Tariff and Charging Administration (TCA) covers the part of the management activities related to the tariffs in the NEs and to charging data of a service usage. The activities may include creation, interrogation, modification and deleting and managing of the data collecting process. The activities include all types of methods used to verify that the charging data is correct.

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

Components of service:

1)   Administration of a tariff for service;

2)   Management of data collecting process for billing, accounting and service provisioning;

3)   Management of pay-phone charging.

5.4.2 TIB A: TMN management service function list

Create tariff class: TMN directs NE to create a tariff class corresponding to a certain service, origination and destination.   TCA 1

Delete tariff class: TMN directs NE to delete a tariff class.

Set tariff class: TMN directs NE to change a tariff class.

Get tariff class data: TMN requests NE to report the defined tariff class data, NE replies with the data.

Create a tariff: TMN directs NE to create a tariff.

Delete a tariff: TMN directs NE to delete a tariff.

Set a tariff: TMN directs NE to change a tariff.

Get tariff data: TMN requests NE to report tariff data, NE replies with the data.

Create tariff period of the day: TMN directs NE to create a new tariff period of the day

                                                                                                            (NOTE 3)

Delete tariff period of the day: TMN directs NE to delete an existing tariff period of the day.

Set tariff period of the day: TMN directs NE to change a tariff period of the day.

Get tariff period data of the day: TMN requests NE to report tariff period of the day, NE replies with the data.

Create day class: TMN directs NE to create a day class into the calendar table.

Delete day class: TMN directs NE to delete a day class from the calendar table.

Set day class: TMN directs NE to change a day class in the calendar table.

Get day class data: TMN requests NE to report a calendar table data, NE replies with the data.

Create a data collection: TMN directs NE to set parameters to a charging data collection process.

TCA 2
(NOTE 2)

Delete a data collection: TMN directs NE to remove a charging data collection process.

Activate a data collection: TMN directs NE to start up a defined charging data collection process.

De-activate a data collection: TMN directs NE to stop a defined charging data collection process.

Get data collection data: TMN requests NE to report data of the defined and/or activated data collections.

Set a data collection: TMN directs NE to change parameters in a charging data collection definition.

Get charging record: TMN requests NE to send a charging record; either a call record, or a counter record, or several records, according to the specification in the request. NE replies with the data and saves the data.

Transfer charging block: NE transfers automatically a charging block or several blocks to TMN according to the earlier activated data collection. Call records are deleted in the NE.

Get coin-box status: TMN requests NE to report the status of the pay-phone coin-box. NE sends the requested status data to TMN.

TCA 3
(NOTE 1)

NOTE 1:   Credit card pay-phone authority control, data collection management, etc. are for further study.

NOTE 2:   Inclusion of discriminators or filters to control data collecting is for further study.

NOTE 3:   Management of clock and calendar is assumed to be done within another application service, e.g. system control operations.

5.5 Traffic management

5.5.1 TIB A

Description

This TMN management service is concerned with the management of traffic associated with circuit switched networks such as the Public Switched Telephone Network (PSTN), Integrated Services Digital Network (ISDN) and transmission networks, e.g. the SDH.

The object of traffic management is to enable as many calls as possible to be successfully completed. This objective is met by maximising the use of all available equipment and facilities in any 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, in order to optimise the maximum utilisation of the network capacity.

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

The TMN will collect traffic information from the NE and send commands to that NE to modify its operation or to re-configure the network. The NE may send traffic management information periodically or upon threshold triggering. The TMN 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, via mediation processes or OSs.

In order for the NE digital exchange 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 OSs information. This will be done by processing the information from the measurement sub-system and converting it to a recognised set of traffic management indicators;

- transfer the recognised set of traffic management indicators over the Q3 interface to the OS;

- receive control information from the OS, via the Q3 interface, and execute the appropriate controls to impact the traffic flow.

The operations system should be able to collect all the Traffic Management (TM) indicators to obtain an overall view of the status of the network.

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

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

- CCITT E.411 [1], E.412 [2], E.413 [3], Q.541 [12], Q.542 [13], Z.337 [15];
- T1 210-199x [19];
- CCITT handbook on quality of service, network management and network maintenance;
- ETR 048 [18].

If further information is needed, it is recommended that the reader refers to the CCITT E.400 series of Recommendations.

5.5.1.2 Components of service

1) Network status and performance.

   Periodical or spontaneous collection of information about network status and traffic performance on digital resources of the telecommunications network.

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

   a) Circuit groups.

   Status information:

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

   Status indicators:

   - 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.

   NOTE: Clarification of the meaning of the above lists and whether further additions are required are for further study.

   b) Switching nodes.

   Load measurements:

   - these are provided by attempt counts, usage or occupancy data, on the percentage of real time capacity available or in use, percentage of equipment in use, counts of second trials, 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 Stored Program Control (SPC) exchanges which show the degree of congestion.

     These indicators can show:

     - moderate congestion (level 1);

     - serious congestion (level 2);

     - unable to process calls (level 3).

Network performance information includes:

- traffic on each circuit group;

- traffic to each destination;

- effectiveness of network management actions.

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

- Percentage OverFLow (% OFL);

- Bids per Circuit per Hour (BCH);

- Answer Seizure Ratio (ASR);

- Seizures per Circuit per Hour (SCH);

- occupancy;

- mean holding time per seizure;

- Busy-Flash Seizure Ratio (BFSR).

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.

2) Traffic management actions.

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 circuit groups or into distant exchanges which are already experiencing congestion;

- OSs 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 the last few idle circuits in a circuit group for a particular type of traffic.

Expansive actions:

- establishing temporary alternative routing arrangements in addition to those normally available;

- temporarily reorganising 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:

   1   cancel to;

   2   cancel from;

   3   skip;

   4   announcement change;

   5   code blocking;

   6   temporary alternative routing;

   7   circuit directionalisation;

   8   selective circuit reservation;

   9   call gapping;

   10   circuit turndown / busying / blocking.

3)   Traffic management information distribution.

-    distribution of the traffic management information to other OSs related to other network activities (e.g. planning);

-    distribution of traffic congestion management information to the NEs able to take autonomous corrective actions and to the ones interested by the control;

-    distribution of traffic management information from one administration to another (i.e. international boundary) over an X interface. This may be code blocking in the event of a national disaster.

5.5.2   TIB B management service function list

1)   Status monitoring functions.

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 (CCSSs), interface equipment and other major exchange equipment units. Such reports may be generated automatically, or in response to an operator request.

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.

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.

Report the congestion status of exchanges: this function automatically reports the current congestion status of exchanges for display on a terminal or other device.

Report status of hard to reach destinations: this function provides current information on the hard to reach status of network destinations. Such information can be based on messages received from distant exchanges or on information developed locally in the exchange.

Manually add/remove Hard To Reach (HTR) status of destinations: this function allows an operator to manually assign or remove HTR status to destinations and override automatic HTR designations.

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.

Request network status information: this function provides the ability for the OS to poll the NE to receive specified network status information.

Requested network status information report: this function provides the ability for the NE to transmit on a requested basis, a pre-defined report containing network status information to the OS.

Periodical network status information report: this function provides the ability for the NE to transmit on a periodical report, specified network status information to the OS.

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.

Send autonomous scheduled Network Traffic Management (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.

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.

Send autonomous unscheduled NTM event report: this function provided the ability for the NE to transmit a message to the OS, 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 controls being activated, or of reference data changing. This function deals only with the ability to generate these spontaneous messages.

Request NTM metrics: 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 the poll which trunk groups, controls, etc. it wants sent to it. It also specifies which measurements it requires to be associated with each object. The NE responds with one or more messages giving the specific information requested.

2)   **Performance monitoring functions.**

Report circuit group data and parameters a scheduled basis: this function involves the reporting of circuit group traffic data and calculated network parameters automatically according to a schedule.

Report circuit group data and parameters on demand: this function involves the reporting of circuit group traffic data and calculated NTM parameters in response to an operator request.

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.

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.

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.

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.

Request performance information: this function provides the ability for the OS to poll the NE to receive specified performance information.

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.

Periodical performance information report: this function provides the ability for the NE to transmit in a periodical report, specified performance information to the OS.

Performance information report: this function provides the ability for the NE to transmit on an event basis, specified performance information to the OS.

3)   Alarm surveillance functions.

Report alarm: this function provides the NE with the ability to notify the OS of alarm information upon the occurrence of an alarm.

Route alarm report: this function provides the OS with the ability to specify to the NE the destination address(es) for a specified set of alarm reports.

Request alarm report route: this function provides the OS with the capability to request the NE to send the current assignment of the destination address(es) for a specified set of alarm reports. The NE responds with the current assignment of destination address(es).

Allow/inhibit alarm reporting: this function provides the OS with the ability to instruct the NE to allow/inhibit alarm reports to the OS.

Report current alarm summary: this function provides the ability for the NE to send to the OS (based on a pre-defined schedule) a current alarm summary.

Route current summary: this function provides the OS with the ability to specify to the NE the destination address(es) for a specified set of current alarm summaries.

Request current alarm summary route: this function provides the ability for the OS to request the NE to send the current assignment of the destination address(es) for a specified set of current alarm summaries. NE responds with the current assignment of destination address(es).

Request current alarm summary: this function provides the ability for the OS to request the NE to send a current alarm summary. NE responds with the summary.

Allow/inhibit audible/visual alarm indications: this function provides the OS with the ability to instruct the NE to allow/inhibit the operation of specified alarm indication/recording devices such as lamps, speakers, printers, etc.

Reset audible alarms: this function provides the OS with the ability to instruct the NE to reset specified audible alarm indicators.

4)   Control functions.

These functions provide for the manipulation of manual and automatic controls to directly affect network traffic. These functions often have an immediate effect and must be accomplished in a timely manner. In this and subsequent subclauses, three types of traffic controls are mentioned:

-      **manual controls**: are those controls that are managed from either a local terminal at the NE or remotely via the OS and unconditionally affect traffic. No triggering condition is required to activate a manual control. A manual control remains in effect until removed;

-      **type A automatic controls:** are those controls that are defined in the controlling NE such as automatic call gap controls. All information related to the automatic control is sent from the initiating NE to the controlling NE;

-      **type B automatic controls:** are those controls that are defined and administered in the controlling NE and are triggered by a condition within the controlling NE or upon receipt of an alerting message from another NE. An example of an internally activated control is a trunk reservation control. An example of an externally activated control would be a control or series of controls being activated in response to a Dynamic Overflow Control (DOC) signal being received.

Apply manual NTM control: this function provides the ability for the OS to apply a manual control instruction into the NE. The OS specifies all relevant information such as the associated trunk group and the action to take.

Modify manual NTM control: this function provides the ability for the OS to change the parameters controlling the effects of a manual control. Permissible modifications could include such things as percentage of traffic re-routed, skipped, etc., or alternate trunks.

Remove manual NTM control: this function provides the ability for the OS to remove a manual control instruction from the NE.

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 routed to it.

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 as special recorded announcement.

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.

Override automatic NTM control: this function provides the ability for the OS to suppress an automatic control previously inserted in a NE. This function applies to both type A and type B automatic controls (within the controlling NE).

Remove override of automatic NTM control: this function provides the ability for the OS to restore an automatic control that has previously been overridden. The control will now effect the flow of traffic if currently triggered or as soon as it becomes triggered. This function applies to both type A and type B automatic controls.

Modify active automatic NTM control: this function provides the ability for the OS to change the parameters controlling the effects of an automatic control. This function is performed whilst the control is actively managing traffic. Permissible modifications could include such things as percentage of traffic re-routed, skipped, etc., or alternate trunks. This function applies to type B automatic controls only.

Remove NTM controls by type: this function provides the ability for the OS to remove all type B automatic or manual controls of a particular type. This function could be used to remove all cancel to or all re-route controls within a NE.

Override all NTM automatic controls by type: this function provides the ability for the OS to suppress all automatic controls of a particular type. The automatic controls are not removed from the switch. This function applies to both type A and type B automatic controls.

Remove all NTM controls: this function provides the ability for the OS to remove all type B automatic and manual controls from the NE.

Override all automatic NTM controls: this function provides the ability to suppress all automatic controls within a NE. The automatic controls are not removed from the switch.

5)   Log functions.

Allow/inhibit logging: this function provides the ability for the OS to instruct the NE to allow/inhibit logging of log records.

6)   Administrative functions.

Establish/change/remove a measurement schedule: this function relates to the manipulation by the operator of the traffic measurement 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 measurements.

Establish/update a traffic management database: this function relates to the establishment and updating of a database in the exchange or operations system of network statistics and information necessary to perform the network management function.

E**stablish/change/remove thresholds for status reporting, data reporting and HTR determination:** this function involves the establishment and on-going maintenance by the operator of the values for the various thresholds in the exchange or operations system for data calculation and reporting and automatic control activation.

Establish/change/remove schedules for status data reporting: this function relates to the establishment and on-going maintenance by the operator of the schedules in the exchange or operations systems for the reporting of status and network performance data.

Report routing table information on demand: this function involves the reporting to the operator of routing table information which resides in the exchange of operations system in response to an operator request.

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. The NE responds with the specified schedule.

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.

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.

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.

Condition alarm reporting: this function provides the OS with the ability to instruct the NE to assign event forwarding discriminator attributes as specified by the OS.

Request alarm fault control condition: this function provides the OS with the ability to request the NE to send the current assignment of specified event forwarding discriminator attributes. NE responds with the current assignment of specified attributes.

Schedule current alarm summary: this function provides the OS with the ability to specify to the NE a schedule for reporting current alarm summaries.

Request current alarm summary schedule: this function provides the OS with the ability to request the NE to send the current schedule information for the current alarm summary reporting. The NE responds with the schedule information.

Condition alarm event criteria: this function provides the OS with the ability to instruct the NE to specify alarm attributes (e.g. thresholds) used by the NE to determine if an event is to be considered an alarm.

Request alarm event criteria: this function provides the OS with the ability to request the NE to report the current assignments of specified attributes (e.g. thresholds) used to determine if an event is to be considered an alarm. The NE responds with the current assignment.

Define automatic NTM control: this function provides the ability for the OS to specify an automatic 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 automatic control will not affect traffic even if triggered. This function applies to type B automatic controls. It may also apply to type A automatic controls in the NE generating the request for the automatic control.

Modify inactive automatic NTM control: this function provides the ability for the OS to change the parameters controlling the effects of an automatic control. This information is performed whilst the control is either suppressed or not triggered. Permissible modifications could include such things as percentage of traffic re-routed, skipped etc. or alternate trunks. This function applies to type B automatic controls. It may also apply to type A automatic controls in the NE generating the request for the automatic control.

Delete automatic NTM control: this function provides the ability for the OS to remove an automatic control instruction from the NE. The control may be removed regardless of whether it is being overridden or is currently managing traffic. This function applies to type B automatic controls. It may also apply to type A automatic controls in the NE generating the request for the automatic control.

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.

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, metrics being generated, etc.).

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 information is extracted from the changed log and contains all changes that have occurred since the last change audit report.

Request NTM historical report: this function allows the OS to request data from the NE concerning a previous period.

Request NE clock: this function provides the ability for the OS to obtain the current time at the NE.

Create trigger: this function provides the ability for the OS to define a trigger condition (threshold) that can activate one or more automatic controls.

Modify trigger: this function provides the ability for the OS to alter the trigger condition (threshold) that is used to activate one or more automatic controls.

Remove trigger: this function provides the ability for the OS to remove a trigger condition (threshold) that could have activated one or more automatic controls.

Define response related table entries: this function provides the ability for the OS to specify information used in the administration of one or more controls (e.g. a list of HTR numbers, identification by alarm level and traffic type of the rate or percentage of control used by certain types of controls). This function effects information that is not directly associated with the control itself.

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 effects information not directly associated with the control itself.

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.

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 which measurements and objects are to be included in subsequent NTM summary reports.

Request NTM summary report generation schema: this function provides the ability for the OS to retrieve the information controlling what the NE includes in a NTM summary report.

Modify NTM summary report generation schema: this function provides the ability for the OS to alter the information controlling what the NE includes in a NTM summary report.

Remove NTM summary report generation schema: this function provides the ability for the OS to delete the information controlling what the NE includes in a NTM summary report. The summary report defined by the deleted NTM summary report generation schema will no longer be produced.

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 which meets the specified conditions are transmitted to the OS.

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.

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.

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.

Define audit generation schema: this function provides the ability for the OS to initially define the information the NE includes in an audit report. The audit generation schema specifies what audit information is to be included in subsequent audit reports.

Request audit generation schema: this function provides the ability for the OS to retrieve information controlling what the NE includes in an audit report.

Modify audit generation schema: this function provides the ability for the OS to alter the information controlling what the NE includes in an audit report.

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.

Condition logging: this function provides the OS with the ability to instruct the NE to assign log attributes as specified by the OS.

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.

Request alarm history: this function provides the OS with the ability to request the NE to send specified historical alarm information. NE responds with the specified information.

Define 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. log full behaviour).

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.

Remove change log schema: this function provides the ability for the OS to remove a change log within the NE.

5.5.3 Glossary of terms used in subclause 5.5

Traffic management information: the set of information produced in the TM centre describing the network status performance, the abnormal conditions detected, the problems identity and the TM controls.

Traffic management raw data: Information provided by the NE and used for the production of TM parameters and for display on alerting devices.

Traffic management indicator: A set of standard signals to express distinct load conditions on the traffic resources of a NE.

Traffic management parameters: Information produced in the TM centre, to be used for the production of abnormal condition reports and for display on alerting devices.

The following documents are relevant to this contribution and have been taken into account for this ETR:

CCITT Handbook: Handbook on quality of service, network management and network maintenance.

CCITT Recommendations   E.411 [1], E.412 [2], E.413 [3], Q.541 [12], Q.542 [13] and Z.337 [15].

ETR 048 [18].

T1.210-199x [19].

5.6 Customer administration

5.6.1 TIB A

Description

Customer administration is a management activity that the network operator performs in order to exchange with the customers, all the customer related management data and functions required to offer a telecom service, and to exchange with the network, all the customer related management data and functions necessary for the network to produce that telecom service.

In a wide sense this could include interactions for the purpose of service provision management, configuration administration, fault administration, charging administration (including detailed billing), complaints administration, quality of service administration, traffic measurement administration, etc. Here, however, only customer administration in the more traditional sense of service provision, service configuration and complaints management has been included.

5.6.1.1 Components of service

Manage service provision: after receiving a customer order, find an available directory number and an available equipment number (device) in a suitable exchange and connect these. In case the customer is moving within the exchange area the directory number is connected to a new equipment number (a new customer line). Record customer name, address, etc.

Administer service facilities and supplementary services: record user service requirements as data related to directory number. Some services can be both customer controlled and operator controlled. Examples are abbreviated dialling, priority, malicious call tracing, charging observation, traffic restriction, free of charge, etc.

Administer customer line: administrate line characteristics (line status, traffic direction, line class signalling type, attenuation, equalisation, etc.).

Manage line test: initiate line test with suitable control data.

5.6.2 TIB A: management function list

1) Insert, delete, modify, read single and multi-line customers;

2) Insert, delete, modify, read customer (supplementary) service;

3) Block, unblock single and multi-line customers;

4) Block, unblock customer (supplementary) services;

5) Activate, de-activate malicious call tracing;

6) Activate, de-activate charging observation;

7) Activate, de-activate line test and measurement.

5.7 Routing and digit analysis administration

5.7.1 TIB A

Description

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 CCITT Recommendation E.412 [2] should be met.

In specifying the managed object classes for routing, certain requirements must be met:

1) it must be possible to verify routing information in an exchange, with a minimal distortion in the normal operation of an exchange;

2) it must be possible to switch between routing tables according to a pre-defined timing schedule, e.g. by introducing scheduling for routing tables;

3) define functionality in such a way that routing tables may be changed easily;

4) avoid redundant information by making use of objects which exist during run time;

5) it must be possible to expand the model with future requirements, therefore the specification of object classes for routing purposes must be expandable.

5.7.1.1 Components of service

For further study.

5.7.2 TIB A: management function list

For further study.

5.8 Staff work scheduling

5.8.1 TIB A

Description

The quality of telecommunication services offered to the customer depends very much on the network operator's staff. Although this application service has no direct influence on NEs, it should be considered that effective Staff Work Scheduling (SWS) helps to keep the staff effort on an economic level.

Accordingly SWS is a management activity of the network operator in order to select the appropriate staff member for the work to be performed. This is valid not only for O&M of NEs, but also for maintenance and installation work to be carried out at the customers' premises. Furthermore, staff have to be scheduled for installation or repair work in the field, e.g. for cables, micro waves, etc.

5.8.1.1 Components of service

SWS can be subdivided into the following components:

Database management:

- management of staff records;

- management of working areas; the working area is pre-defined depending on task specific criteria's, e.g. one or more exchange areas, political administration areas (communities, rural districts, etc.).

Selection of staff:

- identification of the working area; after receiving a work order, the working area where the work has to be performed is to be identified. Depending on the work order, the key for identification can be, e.g. the customer's directory number or address, exchange id, cable id, etc.;

- checking the aptitude of the staff concerned; depending on the task to be fulfilled, a check has to be done as to which of the staff members are able to do the job, i.e. who has the expertise (e.g. training for a special task);

- check of security requirements; if the work is to be performed in a restricted area, a check has to be made whether the staff member in question has the admittance permission;

- mapping; staff members with the demand aptitude which fulfil the demanded security requirements will be selected if their working area maps together with the location named in the work order. To minimise travelling time the present locations of staff members in question have to be considered;

- availability check; it has to be checked whether the staff member in question is on duty or not when the work is to be performed.

Materials ordering:

- according to the work order, spare parts, materials, transportation facilities, test equipment, etc. have to be reserved for the scheduled staff and an appropriate order has to be issued to the stock (interface to "materials management").

Scheduling of staff:

- work scheduling; according to the work order, a time frame has to be calculated considering given priority. The time frame terminates with the latest possible time and date when the work must be finished. Allowing enough spare time for unexpected problems and considering the average duration for that kind of work order, the latest starting time can be calculated;

- assignment of staff; when one of the appointed staff members is available at the calculated starting time (or even earlier), the person in question will be assigned for the task.

Dispatching of staff:

- when the assigned staff member has closed the last job, the new work order (with all relevant data) will be dispatched to him/her.

Job completion:

- after closing a job, the staff member reports working information for statistical purposes.

5.8.2   TIB A: management function list

1)   Related to database management.

Initialise: configuration of a new database which is related to a NE/group of NEs.

Update: adding, modification or deletion of one or more records in the database related to a NE.

Query: reading all or part of the date base contents related to a NE/group of NEs.

2)   Related to selection of staff.

Set working area attributes: assignment of designated parameters to working area attributes. These are used to identify a working area based on specific parameters such as NE ID(s), directory number(s), etc.

Request working area data: request to report data of the identified working area.

Report working area data: report of data concerning a specific working area.

Set staff record attributes: assignment of designated parameters to staff record attributes (e.g. working area, special training courses, availability, etc.)

Request staff record data: request to report data of the identified staff record.

Report staff record data: report of data concerning a specific staff record.

Connect/Disconnect area-staff: assignment or withdrawing of staff to or from a working area.

3)   Related to materials ordering.

Request material's availability: request to report the availability and the storage location of specified material (interface to "materials management").

Report material's availability: report of material's availability and its storage location.

4)   Related to scheduling of staff.

Set work order attributes: assignment of designated parameters to work order attributes (e.g. assigned staff member, what to do, needed materials, where to do, etc.).

Request work order data: request to report data of the identified work order.

Report work order data: report of data concerning a specific work order.

Connect/disconnect order-staff: assignment or withdrawing of a work order to or from a staff record.

Set work schedule attributes: assignment of designated parameters to schedule attributes (e.g. time slot, estimated duration, etc.).

Request work schedule data: request to report data of the identified work schedule.

Report work schedule data: report of data concerning a specific work schedule.

Connect/Disconnect order-assignment or withdrawing of schedule: a work order to or from a work schedule.

5)   Related to dispatching of staff.

Request work order status: request to report the current status of work order assigned to a staff record.

Report work order status: report of the current status of work order assigned to a staff record.

Modify work order status: modification of the current status of a work order.

6)   Related to job completion.

Set work order attributes: assignment of designated parameters to work order attributes (e.g. work results, used materials, duration, etc.).
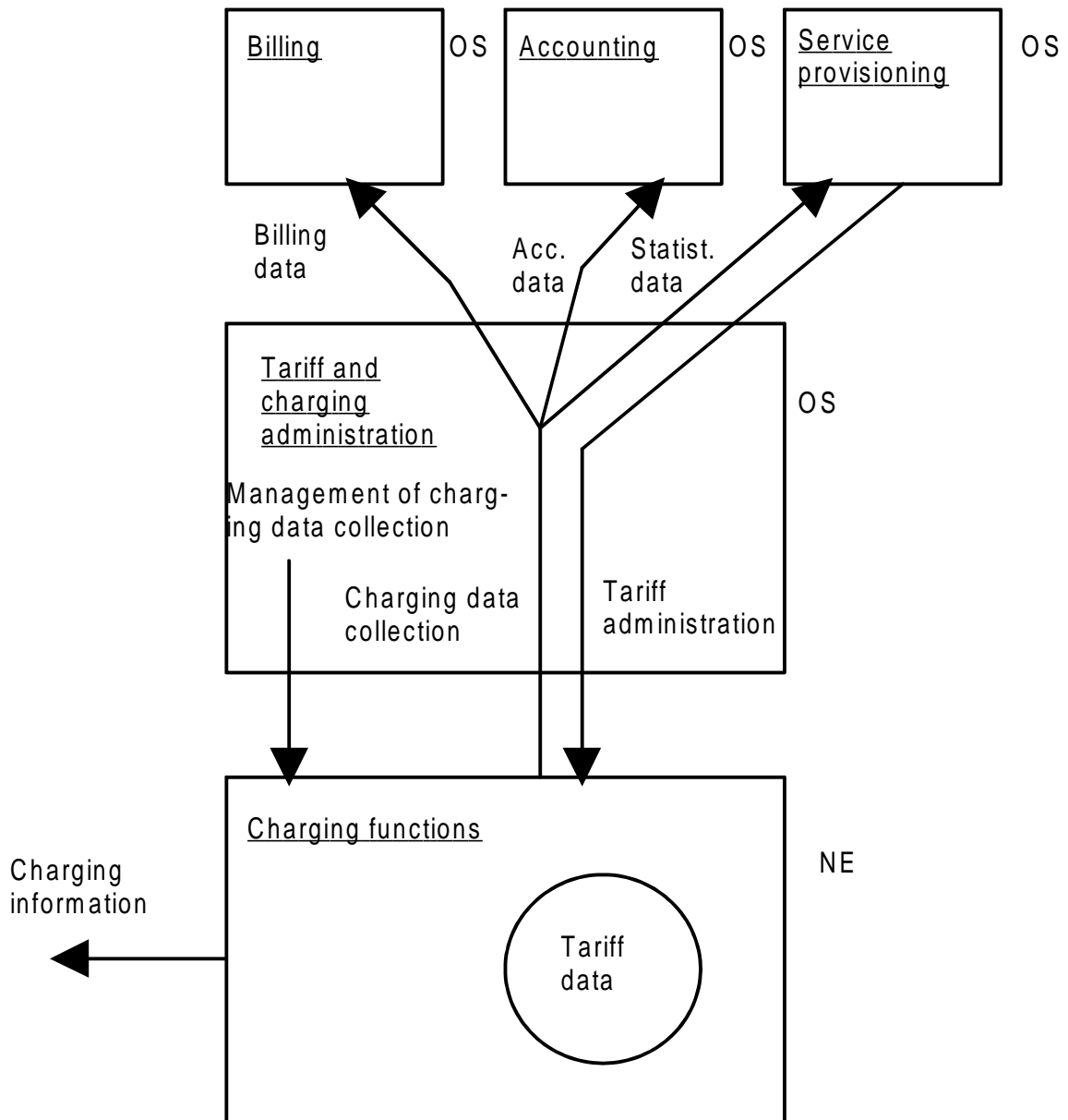
Figure 5: Application service overview

5.9   Materials management

5.9.1   TIB A

Description

Materials management of stores, Operations and Maintenance Centres (OMCs), exchanges, etc. enables a network operator to form the required maintenance and installation work. Although this management service has no direct influence on NEs, it should be considered that a sophisticated materials management supports network operators to keep investment cost for spare parts and installation material as low as possible.

5.9.1.1   Components of service

Materials management can be subdivided into the following components:

database management:

-        management of the basic set of materials (e.g. prices, ordering numbers, compatibilities, etc.);

-        management of the basic data of every stock (e.g. address, telephone number, size, etc.);

-        inventory management; the quantity of materials and their present storage place and ownership has to be managed;

provisioning:

-        incoming orders/reservations. When materials have been requested from the store they have to be reserved immediately to avoid double booking;

-        prognosis. To optimise the stocks, the demand for all materials has to be observed;

-        repair order. Before procuring new materials in lieu of faulty ones, it has to be checked whether repair is possible and whether guarantee is expired or not. Depending on the result, a repair order has to be issued and has to be sent (with the faulty materials) to the repair shop or to the manufacturer;

-        compatibility check. Different releases of dedicated spare parts may depend on different hardware or software releases in the NE (e.g. switching equipment);

procurement:

-        placing orders;

-        arrangement for payment;

-        supervision of delivery (target date, quantity);

storekeeping:

-        supervision of goods entry and outgoing stocks;

-        shelf addressing (storage place);

scrapping administration:

- selection of materials which are faulty and unrepairable or written off to be scrapped or to be sold;

- placing scrapping orders;

dispatching:

- OMCs of shipping documents;

- dispatching handling;

5.9.2 TIB A: management service function list

1) Related to database management.

Initialise: configuration of a new database which is related to a NE/group of NEs.

Update: adding, modification or deletion of one or more records in the database related to a NE.

Query: reading all or part of the database contents related to a NE/group of NEs.

2) Related to provisioning.

Set material attributes: assignment of designated parameters to material attributes (e.g. reserved, faulty, guarantee expired, compatible to, etc.).

Request material data: request to report data of the identified material.

Report material data: report of data concerning a specific material.

Calculate material demand data: request to calculate material demand data to given parameters.

Report material demand data: report of the calculated material demand data.

Set order attributes: assignment of designated parameters to order attributes (e.g. material id, quantity, delivery date, accounting number, delivery address, etc.).

Request order data: request to report data of the identified order.

Report order data: report of data concerning a specific order.

3) Related to procurement.

Set order attributes: assignment of designated parameters to order attributes (e.g. material id, quantity, delivery schedule, payment, etc.).

Request order data: request to report data of the identified order.

Report order data: report of data concerning a specific order.

Set goods entry attributes: assignment of designated parameters to goods entry attributes (e.g. shipping document id, order id, delivery date, etc.).

Request goods entry data: request to report data of the identified goods entry.

Report goods entry data: report of data concerning a specific goods entry.

4)   Related to storekeeping.

Set store attributes: assignment of designated parameters to store attributes (e.g. store address, ownership, size, etc.).

Request store data: request to report data of the identified store.

Report store data: report of data concerning a specific store.

5)   Related to scrapping OMCs.

Set material attributes: assignment of designated parameters to material's condition attribute (e.g. faulty, damaged, written off, etc.).

Request material attributes: request to report the actual condition attribute of designated material.

Report material attributes: report of the actual condition attribute of designated material.

6)   Related to dispatching.

Set outgoing stocks attributes: assignment of designated parameters to outgoing stocks attributes (e.g. shipping document id, order id, delivery date, etc.).

Request outgoing stocks data: request to report data of the identified outgoing stocks (e.g. shipping documents).

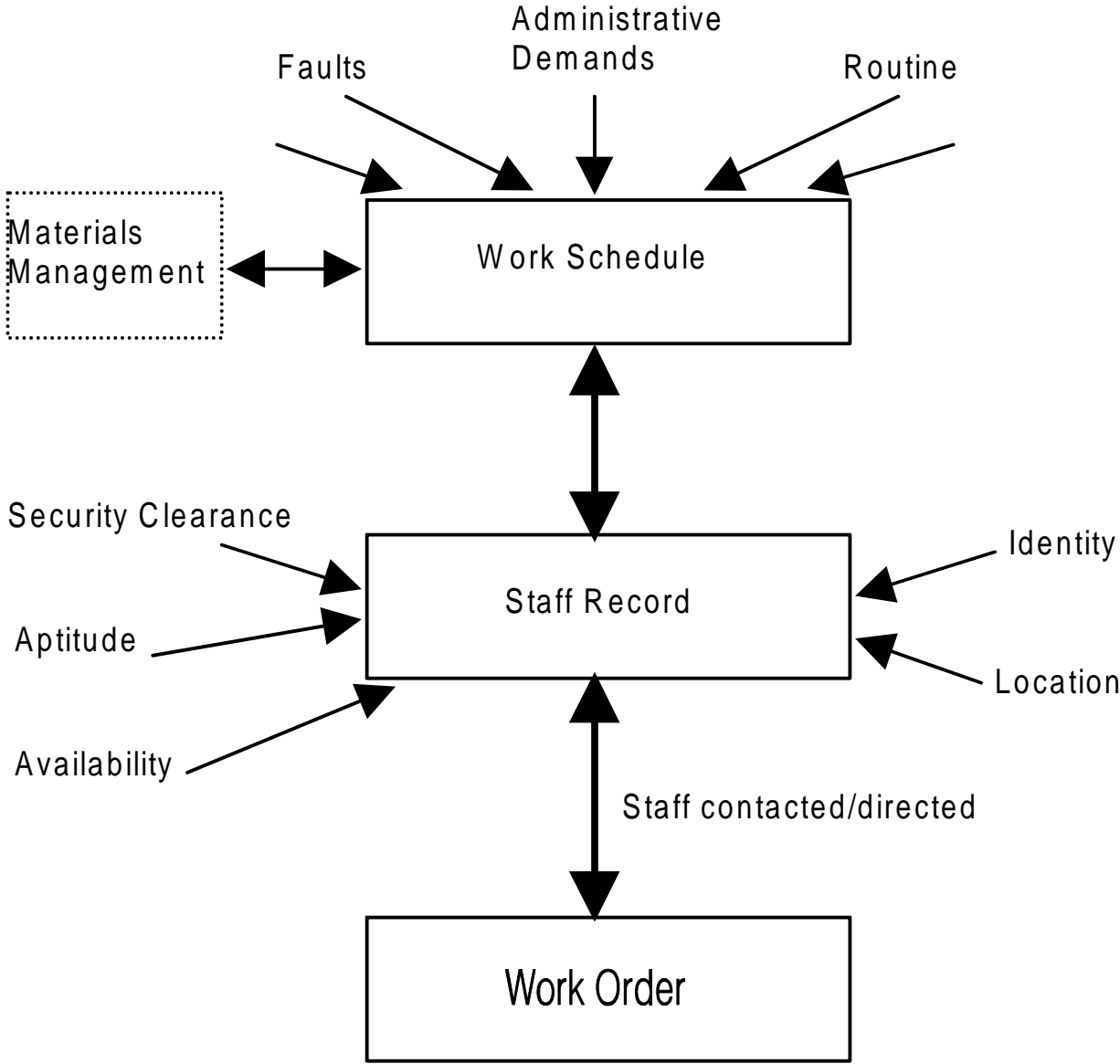**Report outgoing stocks data:** report of data concerning a specific outgoing stocks.

Faults

Administrative
Demands

Routine

Materials
Management

Work Schedule

Security Clearance

Identity

Staff Record

Aptitude

Location

Availability

Staff contacted/directed

Work Order

Figure 6: Application service overview

5.10 Management of intelligent networks

5.10.1 TIB A

Description

The Intelligent Network (IN) functional model shows the association and interaction of several functional entities which, when considering the physical realisation, may reside in entirely separate NEs. The separation of these functional entities into NEs can be as a result of equipment from different manufacturers, or because of geographic separation.

The management arrangements required for an effective operation of such a network, which itself will normally be intimately meshed with other telecommunications networks (Packet Switched Data Network (PSDN), leased lines, Plain Ordinary Telephone Service (POTS) etc.) will probably rely on the layered functional model of TMN OMCs. This is because IN cannot be considered as a simple collection of "objects" but as a selection of some objects from classes of objects supporting other networks. The layering of OMCs will allow localised groupings of objects to administer certain of their attributes for management in common (i.e. failure detection in service switching function of IN and telephone exchanges) whilst management of other attributes, (i.e. data/configuration changes in Service Control Function (SCF), Specialised Database Function (SDF) and Connection call Control Function (CCF)), can be delegated for management in another grouping.

5.10.1.1 Extent of management from TMN of IN

Below are lists of services and service features, Service Independent building Blocks (SIBs) which need management. These lists are only part of an initial standardisation phase worked on by STC NA6 and known as Capability Set 1 (CS1) and will need expansion as IN standardisation progresses.

Services:

- freephone;
- virtual private networks;
- universal personal telecomms;
- OMCs routing;
- abbreviated dialling;
- originating call screening;
- terminating call screening;
- call forwarding;
- call distribution;
- destination call routing;
- selective call forwarding on;
- busy/don't answer;
- security screening;
- credit card calling;
- televoting;
- mass calling;
- call volume distribution;
- call re-routing distribution;
- completion of call to busy subscribers;
- conference calling;
- automatic alternative billing;
- universal access number;
- premium rate;
- split charging;
- account card calling.

Service features:

- reverse charging;
- call volume distribution;
- call gapping;
- call limiter;
- call queuing;
- originating call screening;
- terminating call screening;
- closed user group;
- customer profile management;
- follow me diversion;
- origin dependent routing customised recorded announcement time dependant routing;
- user prompter;
- abbreviated dialling authentication;
- authentication code;
- off network access;
- off network calling;
- attendant;
- mass calling;
- split charging;
- premium charging;
- private numbering plan;
- one number;
- customised ringing;
- call logging;
- call forwarding on busy and don't answer.

SIBs:

- translation;
- announcement;
- collect user info;
- screening;
- authorisation;
- timer;
- billing/charging;
- call gap;
- call logging;
- service data management;
- verification;
- queueing;
- resume call control;
- event/status notification;
- start;
- stop.

5.10.1.2 Components of service

There are three distinct main processes in IN, namely:

a) IN service "creation". This could be better referred to as provisioning, (i.e. construction of a new service). Such a process is part of business management as it impacts on policy decisions relating to tariffing and new equipment purchasing;

b) IN service "administration". This is basically, day by day, administration of existing IN services. Such a process can be considered as part of overall services management (i.e. adding customers, preparing bills);

c) IN service "operation". This is the call by call control of the IN services where alarms and fault reports are monitored and repairs made when appropriated. This can be integrated with NE management so that it can interact with staff scheduling, component provisioning, etc.

5.10.2 Application function list

Sub components description:

a)   IN service "creation":

- operation of service creation environment (management of SIB's);

- management of changes to configuration topology, configuration management of SIB's;

- scrapping services and equipment that are obsolete;

b)   IN service "administration":

- configuration management application function for CCF, SDF, SCF, SRF;

- interaction with the service management agent (ind., screening function, security, etc.);

- report on/make changes to database parameters collecting charge records;

- report on/make changes to thresholds and/or pre-threshold limits, change tariffs;

- management of database working areas;

c)   IN service "operation":

the components of this part of the IN service are those for "switching management" i.e.:

- performance measuring;

- failure detection;

- service test;

- system protection;

- failure information;

- fault localisation;

- fault correction;

- verification;

- etc.

5.11 Common channel signalling systems management

5.11.1 Introduction

5.11.1.1 TIB A

Description

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 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 linkset;

- indication of the initiation of internal flow control procedures.

This network "picture" will enable the right decisions to be made at the right time. 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 the existing CCITT Recommendation Q.791 [14]. 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 and OMCs, signalling routes and their capacities;

- detection of signalling linksets requiring additional capacity;

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

- etc.

The management system should provide links with the Human-Machine Interface (HMI), this would give the ability to manipulate signalling resources. Some of the types of information that could be accessed/altered could be the following:

- control signalling link states;

- introduce new routes;

- reporting of fault conditions;

- collection of statistics;

- change routes.

5.11.1.2 Components of service

Planning:

- signalling links;

- signalling routing;

- signalling configuration;

- signalling dimensioning;

- transmission system (links with transmission planning).

Maintenance:

- detection and correction of faults;

- verification of routing data.

Performance:

- signalling load measurements;

- signalling congestion measurements;

- performance of controls.

Provisioning:

- new signalling links;

- signalling transfer points.

5.11.2 TIB A: TMN management service function list

Message Transfer Part (MTP) signalling link performance:

- signalling link failure:

    - all reasons for failure (on occurrence);
    - excessive delay in acknowledgement (on occurrence);
    - excessive error rate (on occurrence);
    - excessive congestion time (on occurrence);

- signalling link alignment failure (5 minute reports);

- number of signalling units in error (5 minute periods);

- number of negative acknowledgements received (5 minute period);

- signalling links restoration (on occurrence).

MTP signalling link availability:

- Remote Processor Outage (RPO):

    - start of condition (on occurrence);
    - end of condition (on occurrence);

- duration of local busy (5 minute periods);

- start of local inhibition (on occurrence);

- end of local inhibition (on occurrence);

- start of remote inhibition (on occurrence);

- end of remote inhibition (on occurrence).

MTP signalling link utilisation:

- number of SIO and SIF octets transmitted (5 minute periods);

- octets re-transmitted (5 minutes periods);

- number of OMCs transmitted (5 minutes periods);

- number of SIO and SIF octets received (5 minute periods);

- number of OMCs received (5 minute periods);

- signal link congestion indicators (5 minute periods);

- OMCs discarded due to signal link congestion (5 minute periods).

MTP signalling link set and route set availability:

- start of link set failure (on occurrence);

- stop of link set failure (on occurrence);

- start routeset un-availability (on occurrence);

- stop routeset un-availability (on occurrence);

- change in a link set used for a destination(s) including identity of new link set and destination(s) affected (on occurrence).

MTP adjacent signalling point status accessibility:

- MSU discarded - routing error (1st occurrence and 5 minute periods);

- number of OMCs for each OPC/DPC/SIO combination on each link set (5 minute periods);

- receipt of TFC (with destination and congestion level) (1st occurrence and 5 minute periods);

- receipt of UPU (with destination) (1st occurrence and 5 minute periods).

MTP signalling link traffic distribution (route utilisation):

- number of SIO+SIF octets handled with given OPC+DPC+SIO (5 minute periods).

SCCP performance:

- no translation for address of such nature (1st occurrence and 5 minute periods);

- no translation for this specific address (1st occurrence and 5 minute periods);

- network failure (point code not available) (1st occurrence and 5 minute periods);

- network congestion (1st occurrence and 5 minute periods);

- sub-system failure (unavailable) (1st occurrence and 5 minute periods);

- sub-system congestion (1st occurrence and 5 minute periods);

- unequipped user (1st occurrence and 5 minute periods);

- syntax error detected (1st occurrence and 5 minute periods);

- routing failure reason unknown (1st occurrence and 5 minute periods).

Sub-system un-availability:

- start of local SCCP unavailable due to failure (on occurrence);

- start of local SCCP unavailable due to maintenance busy (on occurrence);

- start of local SCCP unavailable due to congestion (on occurrence);

- stop of local SCCP unavailable (all reasons) (on occurrence);

- sub-system out of service request granted (on occurrence);

- sub-system out of service request denied (on occurrence).

SCCP utilisation

- UDTS messages sent (5 minute periods);

- UDTS messages received (5 minute periods);

- total messages handled (5 minute periods);

- messages local sub-systems (5 minute periods);

- messages requiring global title translation (5 minute periods);

- connectionless messages sent (5 minute periods);

- connectionless messages received (5 minute periods);

- messages sent to a back-up sub-system (5 minute periods).

Annex A: Definitions of tariff and charging

A.1 Tariff administration

Management function to set and manipulate tariff in a NE.

Tariff is a set of data within a NE, that is centralised within an IN or distributed into the exchanges, or in an operations system, used for the determination of the amount of payment for used services.

Tariff may include dependency on the tariff class, which is defined according to service, origination and destination, and or the tariff period and day class. These attributes may change during the call.

A.2 Charging administrations

Management function to manage charging functionality, to collect variable data out of NEs and provide information for the billing, accounting and service provisioning.

The charging administration entity is also responsible to verify the correctness of the data.

A.3 Charging function

This is a function within a telecommunication NE that collects and manipulates charging information.

It is not the intention of this ETR to specify charging functions, but they are internal functions of a NE. In this ETR a model of charging functions is provided in order to make their management possible.

Two types of charging must be considered:

-       charging units accumulated on a counter for each subscriber. The units are generated with varying rates depending on the call. Each unit is charged a certain amount;

-       detailed charging where each call generates information about A-subscriber, B-subscriber and possibly C-subscriber and beginning and termination time of the used service. The information may contain the number of charging units of the call.

A.4 Tariffing

The function to tariff, i.e. to decide the price of used services, based on the information of the services (service types) used.

A.5 Pricing

The function to price, i.e. to decide the price of used services based on the tariff and information of the service resources used:

-       some services (i.e. pay-phones, charge advice indications and pulse sending between service providers) require real time tariffing and pricing in a NE.

A.6 Billing

Administrative function to prepare bills to service customers, to prompt payments, to obtain revenues and to take care of customer reclaims.

A.7   Accounting

Administrative function to share revenues between service providers.

The definitions and relationships of these functions are illustrated in figure A.1.
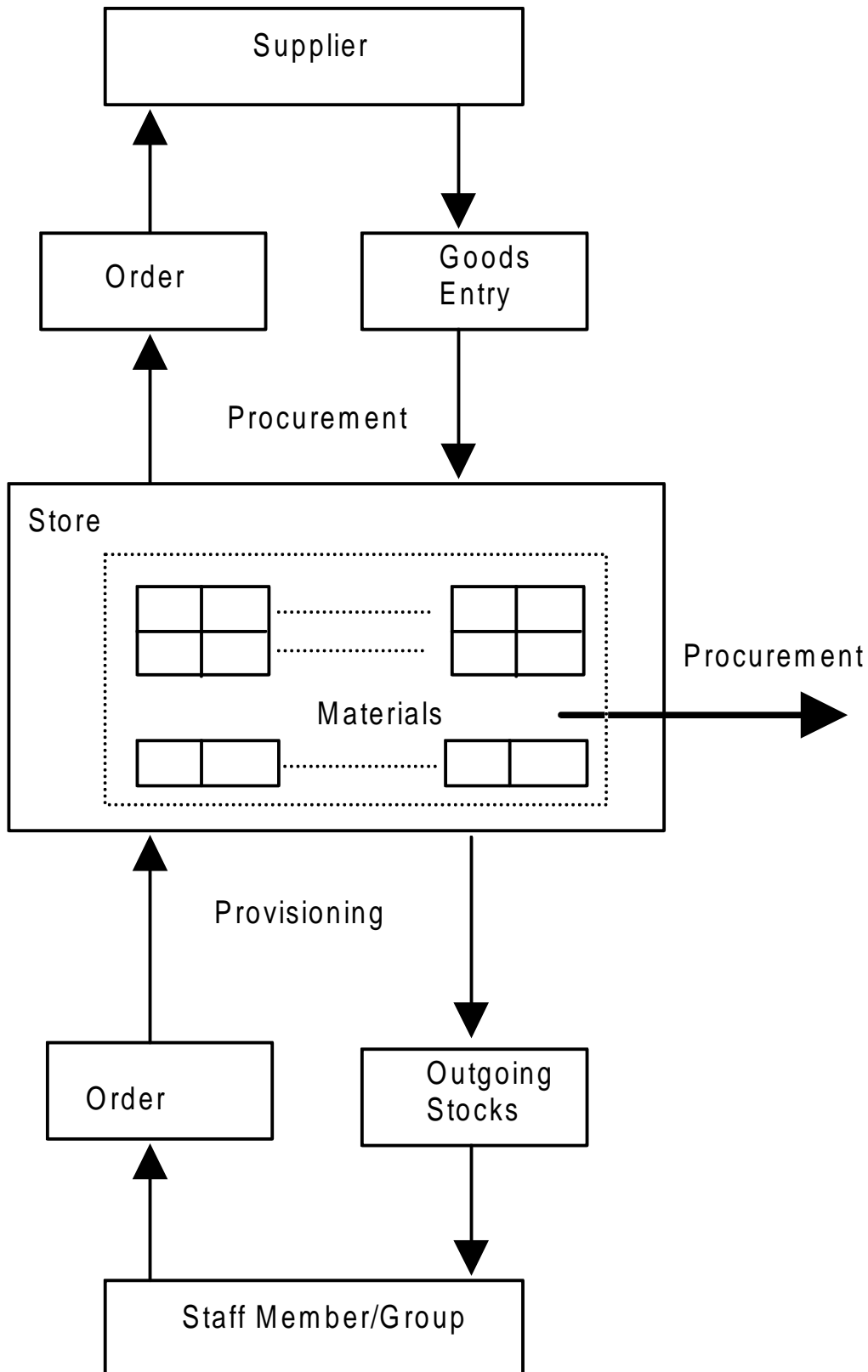

Figure A.1

History

Document history	
September 1992	First Edition
February 1996	Converted into Adobe Acrobat Portable Document Format (PDF)