ECMA

Standardizing Information and Communication Systems

Compendium of PTN
Management Services

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Brief History

ECMA Technical Report TR/54 on the PTN Management Framework specifies a methodology by which work towards standardized management interfaces may proceed. As the initial steps in this methodology it is necessary to investigate the services which the user's management applications will be expected to support and the functions necessary to support these services. The results of this investigation will guide the detailed work on the interfaces identified in ECMA TR/54.

The content of this Technical Report, ECMA TR/67, has been based upon a 'snapshot' of the work of ETSI NA4.3 and ITU-T Q23/4 for the services description and for the functions to support these services (these services and functions have been adapted to suit the PTN environment). The services are not to be standardized and the compendium provided in this Technical Report does not attempt to be exhaustive in its coverage. Instead it explores sufficient material to assist further standardization work.

This Technical Report has been produced under ETSI IMCC work item DTR/ECMA-00105, with the intention of submission to ETSI for publication as an ETR.

NOTE

CCITT underwent a name change during the development of this Technical Report. As a consequence of this, CCITT is now referred to as ITU-T except where a Recommendation being referenced was produced under the CCITT name. The names of Study Groups also changed from Roman to Arabic numerals, and the Working Party number now comes before the Study Group number when referring to a specific Working Party, e.g. WP IV/3 now becomes WP3/4.

This ECMA Technical Report has been adopted by the ECMA General Assembly of December 1994.

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1   Scope

This Technical Report identifies a set of PTN Management Services representative of PTN networks. This list is not meant to be exhaustive nor constricting and, as such, will not be subject to standardization, at least not at this stage. Services identified in this Technical Report may not be complete or necessarily offered in a particular implementation. However, they will provide a check-list to guide the standardization process, ensuring that it supplies all the functionality that is necessary to support the perceived usage of a management implementation.

Each PTN Management Service is briefly described in terms of its activity and identifiable separate component parts. From these the groupings of functions supporting these components are identified.

The range of PTN Management Services, the activity description and the components for each are not to be standardized. The function groupings will only be standardized in so far as they impact interfaces.

2   References

2.1   ECMA references

ECMA-105	Private Telecommunication Networks - Signalling at the S Reference Point - Data Link Layer Protocol (SSIG-L2) (1993)
ECMA-106	Private Telecommunication Networks - Signalling Protocol at the S Reference Point - Circuit Mode Basic Services (SSIG-BC) (1993)
ECMA-133	Reference Configurations for Calls through Exchanges of Private Telecommunication Networks (1989)
ECMA-141	Private Telecommunication Networks - Inter-Exchange Signalling - Data Link Layer Protocol (QSIG-L2) (1993)
ECMA-143	Private Telecommunication Networks - Inter-Exchange Signalling Protocol - Circuit Mode Basic Services (QSIG-BC) (1992)
ECMA-155	Addressing in Private Telecommunication Networks (1991)
ECMA-179	Services for Computer Supported Telecommunications Applications (CSTA) Phase I (1992)
ECMA TR/52	Computer Supported Telecommunications Applications (CSTA) (1990)
ECMA TR/54	A Management Framework for Private Telecommunication Networks (1990)
ECMA TR/57	Private Telecommunication Networks (1991)
ECMA TR/65	PTNX Functions for the Utilization of Intervening Networks in the Provision of Overlay Scenarios (Transparent Approach) - General Requirements (1994)
ECMA/TC32/93/6	Guidelines for the Definition of PTN Managed Object Classes (1st draft, February 1993)

2.2   ITU-T references

Rec. M.3010	Principles for a Telecommunications Management Network (COM IV-R 28)
Rec. M.3200	TMN Management Services (Bath, March 1993)
Rec. M.3201	TMN Management Service: Traffic Management (Bath, March 1993)
Rec. M.3203	TMN Management Service: Management of customer controlled services (Bath, March 1993)
Rec. M.3400	TMN Management Functions (COM IV-R 28)

2.3   ETSI references

ETS 300 189	Private Telecommunication Network (PTN); Addressing (December 1992)
I-ETS 300 291	Network Aspects - Functional Specification of Customer Administration on the OS/NE interface (January 1995)

I-ETS 300 292	Network Aspects - Functional Specification of call routeing information management on the OS/NE interface (January 1995)
Draft TR NA43304	TMN Management Services (NA(91)30, September 1992)
Draft TR NA43306	TMN Management Services: Prose Descriptions (NA(91)31, September 1992)
Draft prETS 300 SIP(1)	ISDN: Attendant Supervisory Information Presentation (SIP) Supplementary Service: Service Description (ECMA/TC32-TG6/92/165, June 1992)

2.4 CENELEC references

ENV 41007	Definition of terms in private telecommunication networks (1989)

3 Definitions

For the purpose of this Technical Report the following definitions apply.

3.1 Imported definitions

PTN   (defined in ENV 41007)

PTN Authority   (defined in ECMA-155 and ETS 300 189)

QSIG   (defined in ECMA TR/65)

For a general range of definitions see ENV 41007-1 and ETS 300 189

3.2 Document-specific definitions

3.2.1 Business Management level

A level (or layer) of the management hierarchy which has responsibility for the total enterprise and is the layer at which agreements between operators are made (described in annex B in ITU-T Rec. M.3010)

3.2.2 Element Management level

A level (or layer) of the management hierarchy which manages each network element on an individual basis (described in annex B in ITU-T Rec. M.3010). It covers:

- Control and coordination of a subset of network elements

- Maintaining statistical, log and other data about network elements

3.2.3 Entity

Defines parts of NEs, e.g. equipment, software, which are separately visible to management.

3.2.4 Network Management level

A level (or layer) of the management hierarchy which has the responsibility for the management of all the network elements, both individually and as a set. It is not concerned with how a particular element provides services internally (described in annex B in ITU-T Rec. M.3010). It covers:

- Control and coordination of the network view of all the network elements within its scope or domain

- The provision, cessation or modification of network capabilities for the support of service to customers

3.2.5 (PTN) Management Service

Similar to the definition of TMN Management Service in CCITT Rec. M.60 except that its scope is PTN Management rather than the TMN. It is also referred to in ECMA TR/54 using the old term of PTN Management Application Service.

3.2.6 PTN Management

Implicitly from ECMA TR/54 this is a TMN-like environment but with a scope restricted to PTNs.

3.2.7 Service Management level

A level (or layer) of the management hierarchy which is concerned with, and responsible for, the contractual aspects of services that are being provided to PTN users or available to potential new PTN users (described in annex B in ITU-T Rec. M.3010). It covers:

- PTN user/Public network point of contact

- Interaction with service providers

- Interaction between services

- Maintaining statistical data (e.g. QoS)

4 Acronyms and abbreviations

AI	Artificial Intelligence
CPU	Central Processing Unit
CSIG	Layer 3 SIGnalling system at the C reference point (see ECMA TR/65)
IVN	InterVening Network
LAN	Local Area Network
MP	Management Process
MS	Management Service
NP	Numbering Plan
OMP	Overall Management Process
PM	Performance Monitoring
PNP	Private Numbering Plan
PTE	Private Telecommunication Entity
PTN	Private Telecommunications Network
PTNX	Private Telecommunications Network eXchange
QSIG	SIGnalling information flows at the Q-reference point
SIP	Supervisory Information Presentation
SS#7	Signalling System No. 7
SSIG	SIGnalling information flows at the S-reference point
TSIG	SIGnalling information flows at the T-reference point

5 Introduction

Management Services are the users' requirements for managing a telecommunication network. As such it must be the aim of the management interfaces to support these requirements even if not all the services are provided by automated equipment (e.g. the OMP or MP). The Management Services thus represent a marketing view.

It is not envisioned that many 'new' Management Services will be documented as they are currently enacted by human operators. These operators interact with the existing management systems so as to realise these Management Services. It must be an aim of standardization to allow for the continuing automation of these services so as to enhance the efficiency of the human operators.

For consideration when identifying Management Services is that such services are relevant to specific areas in the management hierarchy, i.e. Business, Service, Network and Element Management. A human operator can interact with each level in the hierarchy from a workstation and uses different Management Services from each level. This is depicted in figure 1. For example, a maintenance engineer would want to interact at the Element Manager level normally and would need to see manageable objects in far more detail than would operators who are introducing new network users.

Figure 1 - Workstation at different management levels

In support of the above concept, a Management Service Template can be used to organise the categorization process. This is further described in annex A.

Information is included in annex D about the interactions between the services, indicating overlaps, dependencies and information flows.

6 General

Management Services for PTNs have been defined based upon TMN Management Service work undertaken principally for public network equipment. This is because many management features/requirements are shared between public and private networks. The purpose of this compendium is to bring together in a single document an overview of the management services which are relevant to PTNs. Additional Management Services are defined which are required for PTN Management where an equivalent TMN Management Service does not exist. Some of these additional services may also be adapted for use in public networks.

The Functional Groupings have also been based upon work developed for TMN but have been simplified to separate generic activities from the data involved. This has been done to ease the step to an object oriented specification which is required for both PTN Management and TMN.

Annexes have been provided to give more details of some of the additional Management Services, to show how TMN Management services have been adapted and to give an overview of the major relationships between Management Services.

7 Approach to Management Services

Each Management Service that is listed represents a broad area of activity for PTN management. Each Management Service is broken down into a set of Components of Service which represent the general activities that are required to enable the service to be offered.

The management functions which are necessary to support each of these Components can be determined and new functions defined only if none suitable already exist. The functions are grouped for commonalty and rationalised thus avoiding potential duplications of effort.

During the process of grouping and rationalisation of the functions, the requirement(s) for each particular function (identified by the Component(s) of Service it is associated with) can be analysed. This leads to the Managed Objects and messages which are necessary to represent the functions at the management interfaces.

The above process is documented in the methodology described in Technical Report ECMA TR/54 Management Framework. Figure 2 illustrates the methodology and has been drawn from ECMA TR/54.

Figure 2 - PTN-Management methodology illustrated

The Management Services approach compliments the classical object oriented approach as it ensures that all the Managed Objects that are required to support the Management Services are identified. It also allows 'high management level' Managed Objects to be identified which do not directly reflect managed resources but rather represent a composite of resources and so would be difficult to identify purely by using an object oriented approach.

8 Task 1 - Describe MANAGEMENT SERVICES for PTN Management

List of Management Services and Management Service Components

Task 1 of the methodology in ECMA TR/54 calls for each Management Service identified to be described from its user's perspective.

8.1 PTN Management Services

The following services do not imply any implementation aspects of functions within physical building blocks. Each PTN Management Service is annotated to show its origin, and annex C gives information on how each service relates to those developed for the public service equipment.

8.1.1 Name of Service: User aspects administration

[from ITU-T/ETSI]

Description:

Interaction with the PTN Authority is the principle means by which PTN users are able to control their own PTN access. The management service of User aspects administration allows a PTN control authority to interact with the PTN in order to support PTN users. This service is intended to cover all the aspects of dealing with PTN users which will require support from the PTN and will include both logical and physical aspects. However, it should be noted that other management services will need to be called upon for the administration of those aspects not directly associated with the user.

Comprising the logical aspects is the ability for the PTN control authority to allocate and administer the telecommunication services for specific PTN users. Not only does this include the service considerations for an individual user but also it must consider the service interactions of the whole user community on the PTN. It should be noted that this aspect must be considered independently of the user's access to allow for mobility considerations.

On the physical side the PTN control authority will need to be able to interact with the access equipment associated with an individual PTN user. There is a strong relationship here with the Management Service for Management of PTN User Access where access equipment is considered as a whole (independent of individual users). Note that there may not be a fixed relationship between users and the access that they use.

Components of Service:

1. Manage service provision

2. Administer service facilities and supplementary services

3. Administer user's access line

4. Manage line test

8.1.2 **Name of Service: Routeing administration**

[from ITU-T/ETSI]

Description:

The purpose of management of routeing information in a PTNX is to allow a manager to change the PTN routeing information dynamically. In order to provide this service certain requirements should be met:

1. It must be possible to verify routeing information in a PTNX with a minimal disturbance to the normal operation of the PTNX.

2. It must be possible to switch between routeing plans according to predefined conditions, e.g. timing schedule, traffic loading etc.

3. It must be possible to define functionality in such a way that routeing plans may easily be changed.

4. It must be possible to avoid redundant information by using information held by the PTN.

Components of Service:

none specified

8.1.3 **Name of Service: Traffic measurement and analysis administration**

[from ITU-T/ETSI]

Description:

none specified

Components of Service:

none specified

8.1.4 **Name of Service: Tariff and charging administration**

[from ITU-T/ETSI]

Description:

This service is commonly called Accounting.

The tariff and charging administration covers the part of the management activities related to the tariffs in, and influencing, the PTN and to the charging data for service usage. The activities may include creation, interrogation, modification and deleting data, and the management of the data collecting process. The activities may also include all types of methods used to verify that the charging data is correct.

In a PTN environment this service is more to do with charges incurred for services by other networks (e.g. PSTN). There is a correspondence here with interworking between public networks.

Components of Service:

1. Administration of a tariff for a service

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

8.1.5 **Name of Service: Management of the security of PTN Management**

[from ITU-T/ETSI]

Description:

none specified

Components of Service:

none specified

8.1.6 **Name of Service: Traffic management**

[from ITU-T/ETSI]

Description:

The objective 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 network resources in any given traffic situation. It is also seen as the function of supervising the performance of a network and to be able, when necessary, to take action to control the flow of traffic and to optimize usage so as to achieve the maximum utilisation of network capacity.

Initially the work will concentrate upon a PTNX.

The management service will collect traffic information from the PTNX and send commands to it to modify its operation and/or to re-configure the network. The PTNX may send traffic management information periodically or upon threshold triggering. The management service may alter the thresholds and/or the periods at which the NE sends the traffic data.

Components of Service:

1. Network status monitoring

    1.1   circuit groups

    1.2   switching nodes

    1.3   hard to reach (HTR) destinations

2. Network performance monitoring

3. Traffic management control actions

    3.1   protective action

    3.2   expansive action

    3.3   traffic management control

4. Access control

8.1.7 **Name of Service: Management of PTN User Access**

[from ITU-T/ETSI]

Description:

Management of PTN User Access belongs or relates to that part of the PTN covering Terminal Equipment, any sub-network providing access to the PTN and the access termination points on a PTNX. This management service is independent of any specific user on the access, i.e. it relates to the access mechanism between the user(s) and the PTN.

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

Components of Service:

1. Performance monitoring

2. Alarm Surveillance

3. System protection

4. Failure protection

5. Failure localization

6. Fault correction

7. Verification

8. Restoration

9. Configuration

8.1.8   Name of Service: Management of Transport Networks

[from ITU-T/ETSI]

Description:

Management of circuits between PTNXs and associated equipment covers all those functions necessary to bring into service and keep in service analogue or digital circuits between PTNXs. This may also include recorded information services and other circuit-related equipment.

Management of transmission paths covers all those functions necessary to bring into service and keep in service transmission paths. A transmission path is the whole means of transmitting and receiving a transmission signal of specified rate between two points at which transmission termination equipment is connected. Transmission termination equipment originate or terminate signals at the specified bit rate and may include multiplexing or de-multiplexing. The transmission path may contain one or more separate transmission segments. It also includes all equipment associated with the paths, e.g. regenerators, line terminations etc.

Components of Service:

1. Bringing into service

NOTE 1

The Management of Network Scenarios service must be considered as part of this component. This component is reliant upon Management of Network Scenarios to perform its function in a PTN environment.

2. Alarm Surveillance

3. System protection

4. Fault localization

5. Fault correction

6. Verification

7. Restoration

NOTE 2

The Management of Network Scenarios service must be considered as part of this component.

8. Configure terminating equipment

8.1.9   Name of Service: Switching management

[from ITU-T/ETSI]

Description:

Switching Management covers the management of switching of digital paths of 64 kbit/s or higher as occurs in PTNXs. Details of this service can be found in the CCITT Q.500-series Recommendations.

Components of Service:

1. Performance

2. Bringing into service

3. Alarm Surveillance

4. System protection

5. Fault location

6. Fault correction

7. Verification

8. Configuration of PTNX

8.1.10 **Name of Service: System installation administration**

[from ITU-T/ETSI]

Description:

none specified

Components of Service:

none specified

8.1.11 **Name of Service: QoS and Network Performance administration**

[from ITU-T/ETSI]

Description:

none specified

Components of Service:

none specified

8.1.12 **Name of Service: PTN User Access to PTN Management**

[developed by ECMA]

Description:

In this management service the user of the telecommunications network (or networks) being managed (i.e. the 'customer' at a TE) is allowed to interact with the management system of the network(s). This will enable the manageable aspects of the user's configuration to be accessed by the user directly and provide reports on network resources currently allocated to the user. Thus a network user may change his own configuration within the limits allowed by the authority responsible for the network. This may mean increasing or decreasing the range of network services available to him, subject to network performance/policy evaluations and with consequent billing arrangement amendments. The network user may also use this management service to report on calls associated with himself or to monitor information relevant to his network access or to gain access to information relevant to the user's account with the billing authority.

Functionally this will mean that the network user accesses the relevant Management Process (or Operations System) function within the management arena. This management function may be physically located (or just part of it) in (or associated with) the exchange to which the user has access. Alternatively the user may be routed to an external management function. Additionally the workstation function may be within the TE or accessed via the TE.

Components of Service:

1. User Perspective

    1.1   Configuration Control

    1.2   Service Management

    1.3   Call Monitoring

    1.4   Access monitoring

    1.5   Billing

    1.6   Security

    1.7   CSTA

    1.8   Testing

    1.9   Directories

    1.10   Network Status

      1.11   Help Desk

2. Network Perspective

      2.1   Management Access Limitation

This management service is further described in annex F.

8.1.13   **Name of Service: Restoration and Recovery**

[from ITU-T/ETSI]

Description:

Used to bring back into service some part of a network. In an instance where a route was taken out of service, for maintenance or because of a fault, it would be necessary, when bringing the route back into service, to notify switches and transmission systems that the old route is now available.

Components of Service:

none specified

8.1.14   **Name of Service: Management of PTN Network Services**

[developed by ECMA]

Description:

Management of NETWORK SERVICEs covers all those functions necessary to bring into service (includes new services) and to keep in service the telecommunication capabilities provided by a PTN to a network user, including monitoring the performance of the System Facilities comprising a NETWORK SERVICE which provide such capabilities.

Where a component of service relates to a NETWORK SERVICE then this will require orchestration (see annex B) to coordinate the System Facilities comprising the service.

This PTN Management Service provides a framework for general use. Each instance is customised by a set of specific actions to cope with interworking issues between instances of this service.

Components of Service:

1. Performance measuring

2. Bringing into service

3. Alarm Surveillance

4. System protection

5. Fault localization

6. Fault correction

7. Verification

8. Restoration

9. Configure the System Facilities comprising a NETWORK SERVICE

10. Withdraw a NETWORK SERVICE

This management service is further described in annex E.

8.1.15   **Name of Service: Management of Network Scenarios**

Description:

This management service deals with the establishment of the interconnections between PTNXs as identified in ECMA TR/65. Briefly, these scenarios allow for interconnections by:

1) Permanent Intervening Network Connections

2) On-demand Intervening Network Connection

Typically such activities only occur at the establishment of the network or when a change in its configuration occurs. Some of the scenarios, however, call for management involvement during network operation.

NOTE 3

There is a strong relationship between this service and Management of Transport Networks where the Scenarios service can be seen as part of Bringing into service and Restoration. However, due to the complexities involved in managing scenarios and their restriction to PTN environments it has been decided to develop scenario management as a separate management service.

PTN Management will only be involved when permanent or on-demand scenarios are enabled. Typically PTN management will establish an initial connection to coordinate the mapping at both ends between the logical and physical perspectives.

Components of Service:

1. Deciding on which scenario(s)

e.g. specification of communication mechanism to use according to conditions prevailing for calls

2. Allocation of resources between scenarios

e.g. specifying which communication paths are appropriate for each communication mechanism possible

3. Initialization

e.g. identification of communication capabilities, establishing coordinated physical to logical mapping

4. Optimization within scenarios

e.g. scheduled optimization to ensure the best use of resources on a time-of-day basis, or on-demand due to network events

The IVN may be under the responsibility of another network provider. This may cause occasions of reduced working of this service (at least automated working).

This management service is further described in annex G.

8.1.16 Name of Service: Management of Dialling/Numbering Plans

[developed by ECMA]

Description:

Digits dialled at terminals have to be translated into addresses that can be recognised by the PTNXs according to the numbering plan for the network. Such numbers are entered according to a directory which is jointly understood by the terminal user and the PTNX to which the user is connected.

In accordance with ETS 300 189, a PTN Authority can employ as native numbering plans the public ISDN numbering plan (CCITT Rec. E.164), a self-defined Private Numbering Plan (PNP) and an implicit numbering plan (so called "unknown" NP), either exclusively or in any combination of the three.

The impact of interworking with other network types with different numbering plans (e.g. LANs) is not considered in this current description.

This management service allows the PTN Authority to establish either of the three Numbering Plans (NPs), to allocate a range of admissible values to each of them. and to allocate the individual number values to addressable entities, e.g. equipment ports, line ports, etc.

If provided or supported in a particular PTN, this MS will also allow the specification of which other numbering or addressing plans can be used or supported, either as native or as foreign NPs.

8.1.16.1 Details

Beside the creation of NPs, their hierarchical structure can be defined and allocated to functional, geographical etc. ranges within the PTN numbering domain (allowing for the allocation of partial numbers and creation and allocation of numbering "regions" as well as the definition).

Mapping between the numbers of each of the NPs can also be defined.

The permissible prefixes can be defined for NP identifiers and type-of-number values of class "unknown". Their values can be associated with functions to be performed.

For foreign NPs the routeing paths can be defined, e.g. to the public ISDN or to a direct gateway into the corresponding addressing domain.

This seems to be linked into the Management service for Routeing Administration, 8.1.2.

If subaddresses are to be handled by the PTN (e.g. more than just transparently forwarding them) the actions to be taken by PTN equipment can be defined (requires further study).

Components of Service:

none specified

8.1.17   **Name of Service: Management of the PTN Management network**

[developed by ECMA]

Description:

The PTN network comprises a number of discrete management component equipment which inter-communicate via standardized interfaces so as to provide management of the PTN. The management components are distinct (at least logically) from the PTN being managed but form a 'management network' which must itself be managed in a similar manner to the PTN. In most instances the 'management network' will overlay the PTN being managed and so the management of both is intertwined.

Components of Service:

1. Test connection

2. Evaluate impact of management network on PTN

3. Changes to PTN network

8.1.18   **Name of Service: PTN Signalling Management**

[from ITU-T/ETSI]

Covers inter-PTNX communication at layers 1 to 3 as defined by the ECMA QSIG standards:

Layer 3:   ECMA-143

Layer 2:   ECMA-141

Layer 1:   ETS 30011/12 (leased line only) at layers 1 to 3 as defined by the ECMA SSIG standards.

It also covers the PTNX access by terminals at layers 1 to 3 as defined by the ECMA SSIG standards:

Layer 3:   ECMA-106

Layer 2:   ECMA-105

Layer 1:   ETS 30011/12 (leased line only)

Description:

none specified

Components of Service:

none specified

8.1.19   **Name of Service: Supervisory Management Service**

[developed by ECMA]

Description:

Supervisory Information Presentation (SIP) provides for the presentation of supervisory information to the attendants of telecommunications networks. The information provided is not related to any specific call but is of a general nature, providing attendants with additional information on the operational status of the network.

The SIP information is packaged as a supplementary service and is provided by the same mechanism as is used to support the network administrator and in many instances is similar to information presented at management interfaces. For this reason the SIP supplementary service is considered from a management perspective.

SIP provides for a 'read only' access to information, PTN management is used to provide this access and set operational parameters.

Information is provided in the following general categories:

a. Queue information

b. User/access busy/free status

c. Trunk busy/free status

d. Equipment alarms

e. Operational anomalies

Components of Service:

1. Service subscription control

2. Queue information initialization

3. Alarm Surveillance

4. Performance monitoring (queues only)

5. Configuration (busy/free status information)

8.1.20   Name of Service: Management of Mobility

[yet to be developed]

none specified

8.1.21   Name of Service: Configuration of PTN Supplementary Services

[yet to be developed]

Components of Service:

1. Setting defaults

2. Control digit management

8.1.22   Name of Service: Management of Computer Supported Telecommunication Services (CSTA)

[yet to be developed]

Description:

CSTA (see ECMA TR/52 and ECMA-179) Management does not act on CSTA services during normal CSTA operations but administers and monitors CSTA services to detect and react to abnormal conditions. The boundary between CSTA services and CSTA Management service components can not be clearly defined but is a matter of negotiation between CSTA provider and management agency. Some CSTA services components and service parameters, defined in the ECMA CSTA Services standard (ECMA-179), are also relevant for CSTA Management,

Components of Service:

1. System status service (from ECMA-179)

2. Dynamic identifier management (from ECMA-179)

3. Diagnostic error definitions (from ECMA-179)

4. Maintenance event reports (from ECMA-179)

5. Routeing service (from ECMA-179)

6. Computer/Switch Load Management

7. Consistency Management

8. Device/Group Structure Management

9. Device/Group Management

10. Device Management

11. Identifier Management

12. Stand-by Management

13. Supervisory Management

14. User Aspect Management

8.2   Common Management Service Components

There are a number of Management Service Components which can be identified as being common to many Management Services. These correspond to the management functions identified for OSI management and are described below.

*   Configuration changes

This deals with adding to, removing from or changing the configuration which is modelled as a set of objects (CCITT Rec. X.731 or ISO/IEC 10164-2). It also deals with the availability of the resources being modelled (CCITT Rec. X.732 or ISO/IEC 10164-3). How resources interact in the model (CCITT Rec. X.733 or ISO/IEC 10164-4; plus CCITT Rec. X.747) is also covered as is management of software (CCITT Rec. X.744) and time (CCITT Rec. X.743).

*   Alarm Reporting

This deals with detecting and reporting alarm conditions within the network (CCITT Rec. X.733 or ISO/IEC 10164-4, plus CCITT Rec. Q.821). This component has been described in ITU-T Rec. M.3200.

*   Data Reporting

This deals with report of non-alarm information which has not been solicited by an explicit request (CCITT Rec. X.734 or ISO/IEC 10164-5). It also deals with interactions with buffered information (CCITT Rec. X.735 or ISO/IEC 10164-6).

*   Security handling

This deals with reporting of security events (CCITT Rec. X.736 or ISO/IEC 10164-7), performing audit trails (CCITT Rec. X.740 or ISO/IEC 10164-8), access control (CCITT Rec. X.741 or ISO/IEC 10164-9).

*   Testing

This deals with the types of test (CCITT Rec. X.737 or ISO/IEC 10164-14) and performance of testing (CCITT Rec. X.745 or ISO/IEC 10164-12).

*   Analysis

This deals with analysing and summarising data in reports from the network (CCITT Rec. X.738 or ISO/IEC 10164-13).

*   Performance

This deals with the mechanisms for monitoring performance (CCITT Rec. X.739 or ISO/IEC 10164-11, also CCITT Rec. Q.822) and its visible affects (CCITT Rec. X.748).

*   Accounting

This deals with access to the raw data representing available accounting information (CCITT Rec. X.742 or ISO/IEC 10164-10).

9 List of management FUNCTIONAL GROUPINGS

9.1 General

A Management Function is the smallest part of the Management Service as perceived by the user of the service. In reality it will generally consist of a sequence of actions on a defined managed object or objects.

While it cannot claim to be complete, this clause describes some of the most important Management Functions in terms of the OSI management functional areas, expanded to fit the need of a PTN.

The Management Functions have been classified into five Management Functional Areas (as per ISO's OSI Management):

a) performance management,

b) fault (or maintenance) management,

c) configuration management,

d) accounting management,

e) security management.

The list of functions, its terminology and classification is based upon the work of ITU-T Rec. M.3400.

The Management Functions are not intended as requirements for any piece of equipment. Each function is identified because it may be necessary for some implementation of a related Management Service. Some functions will be appropriate for a certain implementation of a Management Service at an interface, but unnecessary or inconvenient for others.

Where possible the management functions should be based upon the OSI Systems Management functions being defined jointly by ISO and ITU-T. The following figure has been drawn from ITU-T Rec. M.3400 to illustrate the relationship between Management Services, Functions and the OSI Systems Management Functions. It also identifies the layer 7 protocol aspects assumed to be supporting the OSI functions.

Figure 3 - Relationship between PTN Management Services and Functions

9.2   **Generic Data Reports**

Where the reporting of data by an agent representing managed entities is involved, there are a number of generic aspects which may apply:

1. Data Report

    The agent sends data, specified as appropriate, on the following trigger conditions:

    a) on demand,

    b) according to a schedule,

    c) on encountering a pre-set threshold exception,

    d) never.

    The type of data that is sent will need to be specified for the conditions which trigger the data report.

2. Data Controls

    The agent may be directed to undertake the following activities:

    a) send a report of specific data (on demand reporting),

    b) alter exception thresholds for data reporting,

    c) specify the type of data to be sent when an exception threshold is encountered,

    d) pre-set counters used as part of the data collection process by the agent,

    e) start/stop data collection,

    f) initialize data to set values,

    g) set discriminators [ISO definition] to filter the data to be collected.

3. Data Analysis

    Data may be collated and/or analysed based upon specified criteria. Data analysis may be nested. It may be used to:

    a) collate data from several sources,

    b) summarise data,

    c) detect patterns within data,

    d) extrapolate trends.

    Data analysis is not restricted to activities performed by PTEs.

The above functional categories are illustrated in figure 4 below.

Figure 4 - Generic data functions

9.3 Performance management

Performance management provides functions to evaluate and report upon the behaviour of telecommunication equipment and on the effectiveness of the network or PTEs. Its role is to gather statistical data for the purpose of monitoring and correcting the behaviour and effectiveness of the network, PTE or equipment, and to aid in the planning and analysis phases. As such, it is carrying out performance measurement requirements such as those identified in CCITT Rec. M.20.
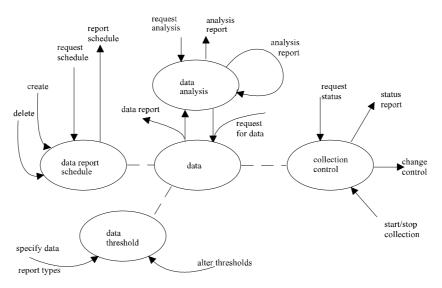
9.3.1 Performance monitoring (PM)

Performance monitoring involves the continuous collection of data concerning the performance of the PTE. While acute fault conditions will be detected by alarm surveillance methods, some very low rate or intermittent error conditions in multiple equipment units may interact and result in a poor service quality. Performance monitoring is designed to measure the overall quality on the monitored parameters in order to detect such deterioration.

NOTE 4

In some cases where the PTE is unable to fulfil all the PM functionality expected it is the Mediation Function which administers PM.

Data reports associated with Performance Monitoring

1. Report circuit group data/parameters

2. Report exchange load measurements

3. Report exchange congestion measurements

4. Report common channel signalling load measurements

5. Report common channel signalling congestion measurements

6. Report data on performance of controls

Although it is not totally clear what the 'controls' refer to it seems to be some automatic mechanism to deal with exceptional traffic conditions. ITU-T Rec. M.3400 gives some further information about the nature of the 'controls'.

9.3.2 Traffic Measurement (TM)

PTN Management collects traffic data statistics from PTEs (or the Mediation Functions representing a PTE).

PTN Management may request traffic data reports to be sent by PTEs, or such a report may be sent upon threshold triggering, periodically, or on demand. At any time PTN Management may modify the current set of thresholds and/or periods in the network.

Reports from the PTE may consist of raw data which is processed by PTN Management, or the PTE may be capable of carrying out analysis of the data before the report is sent.

9.3.3 Status Monitoring Functions

1. Report the service availability of PTEs

2. Report the status of controls

3. Report circuit group busy/idle status

4. Report congestion status of exchanges

5. Report the receipt of automatic congestion control signals

6. Report static routeing information

9.3.4 Control Functions

1. Establish/modify/remove a control

2. Activate/deactivate a control

3. Apply/modify/remove a special recorded announcement

9.3.5 Quality of service (QoS) observations

A PTN Management collects QoS data from PTEs and supports the improvements in QoS. The PTN Management may request QoS data reports to be sent from the PTE, or such a report may be sent automatically on a schedule or threshold basis. At any time, the PTN Management may modify the current schedule and/or thresholds. Reports from the PTE on QoS data may consist of raw data which is processed in a PTN Management, or the PTE may be capable of carrying out analysis of the data before the report is sent.

Quality of Service includes monitoring and recording of parameters relating to:

1. connection establishment (e.g. call set up days, successful and failed call requests)

2. connection retention

3. connection quality

4. billing integrity

5. logs of system state histories

6. initiation of test calls to monitor QoS parameters

The above data categories will be handled via the Generic Data Reporting function. In addition the QoS test call initiation activity needs to be controlled.

9.4 Fault (or maintenance) management

Fault (or maintenance) management is a set of functions which enables the detection, isolation and correction of abnormal operation of the telecommunication network and its environment. It provides facilities for the performance of the maintenance phases from CCITT Rec. M.20.

9.4.1 Alarm Surveillance

A PTN Management provides the capability to monitor PTE failures in near real time. When such a failure occurs, an indication is made available by the PTE. Based on this, a PTN Management determines the nature and severity of the fault. For example, it may determine the effect of the fault on the services supported by the faulty equipment. This can be accomplished in either of two ways: a data base within a PTN Management may serve to interpret binary alarm indications from the PTE, or if the PTE has sufficient intelligence, it may transmit self-explanatory messages to a PTN Management. The first method requires little of the PTE beyond a basic self-monitoring capability. The second method requires additionally that both the PTE and a PTN Management support some type of message syntax which will allow adequate description of fault conditions.

9.4.1.1 Alarm Reporting Functions

This section describes the Alarm Reporting functions provided by the services specified in this Technical Report.

Alarm reporting relates to the following sort of information:

1. Alarms - alarm information upon the occurrence of an alarm

2. Alarm routes - assignment of the destination address(es) for a specified set of alarm reports

3. Alarm History - historical alarm information

The above data categories will be handled via the Generic Data Reporting function.

9.4.1.2   Alarm Summary Functions

This section describes the Alarm Summary functions provided by the services specified in this Technical Report.

Alarm summary relates to the following sort of information:

1. Alarm Summary - Current Alarm Summary

2. Alarm Summary Route - destination address(es) for a specified set of Current Alarm Summaries

The above data categories will be handled via the Generic Data Reporting function.

9.4.1.3   Alarm Event Criteria Functions

This section describes the Alarm Event Criteria functions provided by the services specified in this Technical Report.

Alarm event criteria relates to the following sort of information:

1. Condition for Event to be considered an alarm

The above data category will be handled via the Generic Data Reporting function.

9.4.1.4   Alarm Indication Management Functions

This section describes the Alarm Indication Management functions provided by the services specified in this Technical Report.

Alarm indication management relates to the following sort of activities:

1. Inhibit/Allow Audible/Visual Alarm Indications - PTN Management instructs the PTE to inhibit/allow the operation of specified alarm indication/recording devices such as lamps, speakers, printers, etc.

2. Reset Audible Alarms - PTN Management instructs the PTE to reset specified audible alarm indicator(s)

9.4.1.5   Log Control Functions

This section describes the Log Control functions provided by the services specified in this Technical Report.

Log Control relates to the following sort of activity:

1. Allow/Inhibit Logging - PTN Management instructs the PTE to allow/inhibit logging of Log Records

Log Control relates to the following sort of information:

1. Log Condition - current assignment of specified Log attributes

9.4.2   Fault Location

This section describes the fault location function which is used to augment the initial failure information by the use of additional failure localization routines. The routines can employ internal or external test systems and can be controlled by a PTN Management (see CCITT Rec. M.20).

Fault Location relates to the following sort of information:

1. Fault data - results from running a diagnostic procedure, a specific exercise, an audit, a routine test, a program trace or a loop insulation test

Fault Location relates to the following sort of activity:

1. Operate/release loopback - PTN Management directs PTE to establish or release a specific loopback. It may be activated either remotely by PTN Management or locally by craft action

2. Test internal access path - PTN Management directs PTE to connect a termination on PTE to another termination by a specified path within PTE, then test the path

3. Hold network path - PTN Management directs PTE to hold a particular network path

4. Start/stop program traps - PTN Management directs PTE to start or stop a specific program trap

5. Program trap report - PTE automatically reports to PTN Management the occurrence of a program trap

9.4.3   **Trouble ticket management**

1. Initiate Ticket Reporting

2. Terminate Ticket Reporting

3. Refer trouble ticket (Ownership Transferred)

4. Trouble ticket notification (Ownership Retained)

5. Update trouble ticket data

6. Add sub-ticket

7. Retrieve trouble ticket data

8. Close out trouble ticket

9. Enter Trouble - A user may request that a user access trouble report be created with the appropriate information

10. Add Trouble Information - A user access may provide additional descriptive text for an open trouble report. This additional information will be appended to the description provided when the trouble was originally entered

11. Cancel Trouble - A user access may attempt to close out a trouble report. Typically, the user access has resolved the trouble and wants to abort the trouble report

12. Check Trouble Status - A user access may request status information on an open or closed user access trouble report

13. Review Trouble History - A user access may request information about past troubles reported for a particular service or circuit

14. Report Trouble Status Change - A user access may be notified proactively of changes in the trouble status

15. Request Trouble Report Format - A user access may request information on what conditional package of attributes apply to trouble reports for a particular circuit or service

9.5   **Configuration management**

Configuration management provides functions to exercise control over, identify, collect data from and provide data to PTEs.

9.5.1   **Provisioning**

Provisioning consists of procedures which are necessary to bring an equipment into service, not including installation. Once the unit is ready for service, the supporting programs are initialized via the PTN Management. The state of the unit, e.g. in service, out of service, stand-by, reserved, and selected parameters may also be controlled by provisioning functions.

9.5.1.1   **NE configuration**

NE configuration relates to the following type of information reporting:

1. Entity configuration e.g. status, capacity of the entity, optional parameters, type of entity (in sufficient detail for PTN Management identification) and the version and revision of the version

NOTE 5

Note that an entity could be equipment or software which is included as part of an NE and contributes towards its operation.

2. Channels assigned to a specified entity

NE configuration relates to the following activities:

1. Grow - PTN Management notifies NE of the presence of a newly installed entity

2. Prune - PTN Management notifies NE of the disconnection of an entity

3. Restore - PTN Management notifies NE to begin monitoring the newly installed entity

4. Assign - PTN Management notifies NE that a previously unequipped entity is now equipped

5. Delete - PTN Management notifies NE that a previously unequipped entity is no longer equipped

6. Set service state - PTN Management directs NE to place the specified entity in one of the following states: in service (available for use), out of service (unavailable for use), stand-by (not faulty but not performing normal function), reserved

7. Set parameters - PTN Management directs NE to set parameters associated with a specified entity

8. Set service thresholds - PTN Management directs NE to set performance thresholds for the specified channel

9. Add/drop - PTN Management directs NE to insert or remove a channel from the complement of 'nailed-up' channels

10. Cross-connect - PTN Management directs NE to interconnect two specified channels operating at the same rate

11. Disconnect - PTN Management directs NE to remove the interconnection between two specified channels

9.5.1.2 Administrative functions

Administrative functions relate to the following activities:

1. Set clock - PTN Management directs PTE to set PTE system clock to current calendar, date and time

2. Back-up copy - PTN Management directs PTE to make a Back-up copy of the designated PTE data base file for purposes of archiving for future restoral

3. Terminate procedure - PTN Management directs the PTE to terminate a process between a PTN Management and a PTE

4. Route messages - PTN Management directs PTE to route automatic messages generated by PTE to one or multiple communication channels

5. Set service control - PTN Management directs PTE to assign user access and functional capability

9.5.1.3 Data base management

Data base management functions relate to the following activities:

1. Initialize - PTN Management configures a new data base which is related to a PTE. This may or may not be downloaded to the PTE. This may also include loading a new program related to the PTE

2. Reinitialize - PTN Management reconfigures the data base within a PTE while it is in service

3. Update - PTN Management adds, changes or deletes one or more records in the data base of a PTE. This can be done in a delayed activation mode or upon command entry. It may also be able to enter data base updates on a test basis prior to permanent entry

4. Query - PTN Management reads PTE for all or part of its data base contents

5. Back-up - PTN Management keeps a copy of all or part of the data base of a PTE. In case of memory failure in the PTE, the PTN Management downloads the Back-up copy to the PTE

9.5.2 Status and control

The PTN Management provides the capability to monitor and control certain aspects of the PTE on demand. Examples include checking or changing the service state of a PTE or one of its sub-parts (in service, out of service, stand-by) and initiating diagnostics tests within the PTE. Normally, a status check is provided in

conjunction with each control function in order to verify that the resulting action has taken place. When associated with failure conditions, these functions are corrective in nature (e.g. service restoral).

Status and control functions can also be part of routine maintenance when execute automatically or on a scheduled periodic basis. An example is switching a channel out of service in order to perform routine diagnostic tests.

A PTN Management will enable the exclusion of faulty equipment from operation and as a result it may rearrange equipment or re-route traffic.

A PTN Management can enable the entry of a proposed configuration in order to automatically analyse the feasibility of that design before implementing it.

Administrative functions relate to the following information:

1. PTE status

Administrative functions relate to the following activities:

1. Allow/inhibit automatic restoration - PTN Management directs PTE to allow or inhibit automatic restoration in an M+N or duplex system

2. Operator/release automatic restoration - PTN Management directs PTE 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 stand-by and the stand-by unit becomes the main unit

9.5.2.1 Message handling systems network

Status functions relate to the reporting of the following information:

1. Message storage and forward status

9.5.2.2 Transmission network

Status functions relate to the reporting of the following information:

1. Status of automatic mechanisms for restoration of transmission network elements

9.5.3 Installation

The PTN Management can support the installation of equipment which makes up the telecommunication network. It covers also the extension or reduction of a system. Some PTEs call for the initial exchange of data between themselves and the PTN Management. An example of another function is the installation of programs into PTEs from the data base systems within the PTN Management. In addition, administrative data can be exchanged between PTEs and the PTN Management.

Acceptance testing programs can be done under control of, or supported by, PTN Management.

A detailed list of installation functions for an SPC-exchange is provided in CCITT Rec. Z.331 (3.1).

9.6 Accounting management

Accounting management provides a set of functions which enables the use of the network service to be measured and the costs for such use to be determined.

Accounting functions relate to the following activities:

1. collect accounting records

2. set billing parameters for the usage of services

9.6.1 Billing functions

An OS within the PTN Management can collect data from PTEs which is used to determine charges to user access accounts. This type of function may need extremely efficient and redundant data transport capabilities in order to maintain records of billing activity. Often the processing must be carried out in near real time for a large number of user accesses.

Billing functions relate to the reporting of the following information:

1. Charge records

Billing functions relate to the following activity:

1. Transfer charging block - PTE transfer automatically a charging block or several blocks to the PTN Management according to the earlier activated data collection. Call records are deleted in the PTE

9.7   **Security management**

Security functions relate to the following activities:

1. Change terminal class - PTN Management directs PTE to change the security class of PTE terminal

2. Dial capability - PTN Management directs a PTE to initialize a secure dial-out/dial-back capability to PTN Management

3. Log in - PTN Management sends the appropriate password and identification of a PTE communications channel

4. Log off - PTN Management directs PTE to terminate communication on a channel

5. Change - PTN Management directs PTE to change the log in code assigned to PTE

6. Change dial number - PTN Management directs PTE to change the auto-dial-back number that PTE uses to call back the calling party upon receipt of a dial-out call

7. Horizontal Access Security - A user access should be permitted to manage only those domains belonging to that user access

8. Vertical Access Security - A user access may be permitted to establish and modify the privileges of restricted login user types which are allowed access to only specified subsets of the user access's full capabilities

9. Audit Trials - A user access may have access to usage and security event information

10. Security Alarms - A user access may have access to security alarms which indicate security attacks

11. Management of Audit Trials and Security Alarms - A user access may establish and configure audit trials and security alarms reporting capabilities

12. Intrusion Recovery - A user access may be permitted access Back-up files in order to restore service after a security violation

9.8   **PTN Functions required additional to those in M.3400**

1. Initiate service test - Manager requests Agent to test a service to ensure it is in a fit state for operation

2. Service test result - Agent reports to Manager the results of testing the operation state of a service

3. Restart - Manager requests Agent to restart an equipment, service or the system. The restart may be soft or hard, as called for by the Manager

4. Restart report - Agent reports to Manager that it has undertaken a soft or hard restart as part of its recover procedures. Such procedures may or may not have been initiated by the Manager

5. Automatic restoration report - Agent reports to Manager that it has switched a specified line, service, system or equipment as part of its protection procedures. Such procedures may or may not have been initiated by the Manager

6. Hot stand-by - Manager requests Agent to initiate or terminate hot-stand-by procedures for a service or the system whereby a redundant unit can take over with the minimum disruption to traffic

7. Dump - Manager requests Agent to preserve a record of a service or the system on off-line storage local to the Agent so that its present status could be reconstructed

8. Dump report - Agent reports to Manager that it has taken a dump record of a service or the system. The dump may not have been initiated by the Manager

9. Reload - Manager requests Agent to reconstruct a service or the system (main or stand-by) from a specified dump record

10. Reload report - Agent reports to Manager that it has reloaded a service or system (main or stand-by) from a dump

11. Software patch - Manager sends a software patch to the Agent which is validated by the Agent for acceptability

12. Trial software patch - Manager requests Agent to install a selected software patch on a trial basis. Such patches would be withdrawn in the event of protection mechanisms being activated

13. Install software patch - Manager requests Agent to install a trialed patch on a permanent basis. The Agent validates that this is acceptable

14. Withdraw software patch - Manager requests Agent to withdraw a trialed or permanent software patch. The Agent validates that this is acceptable

15. Service availability - Manager sends Agent timetable of when a specified service is to be available for use

16. Test alarms - Manager requests Agent to simulate a specified failure and mark ensuing actions as dummies

10 Bibliography

CCITT Rec. X.731 or ISO/IEC 10164-2

CCITT Rec. X.732 or ISO/IEC 10164-3

CCITT Rec. X.733 or ISO/IEC 10164-4

CCITT Rec. X.734 or ISO/IEC 10164-5

CCITT Rec. X.735 or ISO/IEC 10164-6

CCITT Rec. X.736 or ISO/IEC 10164-7

CCITT Rec. X.737 or ISO/IEC 10164-14

CCITT Rec. X.738 or ISO/IEC 10164-13

CCITT Rec. X.739 or ISO/IEC 10164-11

CCITT Rec. X.740 or ISO/IEC 10164-8

CCITT Rec. X.741 or ISO/IEC 10164-9

CCITT Rec. X.742 or ISO/IEC 10164-10

CCITT Rec. X.743

CCITT Rec. X.744

CCITT Rec. X.745 or ISO/IEC 10164-12

CCITT Rec. X.747

CCITT Rec. X.748

CCITT Rec. Q.821

CCITT Rec. Q.822

Annex A

(informative)

Management Services Template

In specifying a Management Service it is necessary to cover all aspects to ensure that the functional requirements are addressed. The following 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 relating the concepts contained within hierarchical management to all possible aspects of management, e.g. Performance, Fault, Accounting etc.. A pictorial representation of the template can be found in figure A.1

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

This template is only an example of a tool that may be used and it is not intended to restrict the use of other tools.

Method:

The following is a step-by-step procedure for the template's use:

1. Specify the Management Service.

2. Work through each box in the template. The output from each of the boxes will be a list of the components identified.

3. Expand each component into its respective functional requirements.

Functional area	Fault	Configuration	Performance	Security	Accounting	Others
Business Management						
Service Management						
Network Management						
Element Management						

Figure A.1 - Blank MS template

This annex contains example templates for the Management Services identified in this Technical Report.

The following template has been filled in for the Management Service "Management of NETWORK SERVICES". Details of the components of service identified in the template can be found in annex E.

Functional area	Fault	Configuration	Performance	Security	Accounting	Others
Business Management						
Service Management	2) Into Service 3) Fail detect 8) Verify	2) Into Service 3) Fail detect 6) Localize 11) Withdraw	1) P.M. 3) Fail detect		2) Into Service	
Network Management	3) Fail detect 4) Protection 5) Fail info 6) Localize 8) Verify	2) Into Service 4) Protection 7) Correct 8) Verify 10) Config	4) Protection			
Element Management	3) Fail detect 5) Fail info 6) Localize 7) Correct 8) Verify	2) Into Service 8) Verify 9) Restore				

Figure A.2 - MS template for Management of NETWORK SERVICES

Annex B

(informative)

Orchestration issues

Orchestration applies where management activities for a single management 'operation' have to be coordinated so as to achieve the overall desired effect. There are several different categorizations or problems possible:

1) Synchronization is where the 'operation' needs to influence several managed objects in a coordinated manner. The objects which are involved could be distributed across several separate managed elements. Synchronization becomes critical when the state of the network is threatened by not making all the changes required for a single 'operation' at the same time, and in practice it is necessary to ensure all changes take place within a statistically insignificant time period. Implicit in Synchronization is the ability to recover from failures of implemented management operations.

2) Maintenance of Consistency is closely allied to Synchronization in that there may be many relationships between objects that have to be consistent for the total model to be valid. These relationships have to hold even though the objects are strictly distinct. This is rather more specific than suggested in item 1) above, because the manager may know that there are several related objects that have to be modified simultaneously.

3) Sequencing is allied to the above concepts and is where an operation is dependent upon several TMN nodes in a network being changed in a strict sequence.

4) Conflict occurs when several managers are trying to control the same, or closely related, objects at the same time.

5) Deadlocks occur when a manager has embarked upon a course of action which involves the control of several objects and not all the objects are immediately available as they are locked by another operation which cannot continue until objects locked by the first operation are released. Hence both operations are waiting for the other to do something (note that multiple operations may be involved in a Deadlock).

6) Reporting Correlation is required on occasions when a single 'event' will be detected by a number of distinct agents as separate events. This will require that the manager responsible is able to correlate these separate events so as to detect the underlying 'event' which gave rise to them.

A standardized solution is required for these problems at the interface to allow mixed vendor management. There is a need for an underlying mechanism, at protocol level, but it will be some time before this is available. Until then, solutions will need to be developed for each application as it is required.

Annex C

(informative)

Relationship to Management Services from ITU-T and ETSI

The scope of the PTN Management Services in this Compendium includes those which have been identified by ETSI STC NA4 and ITU-T WP 3/4 as TMN Management Services. Where such TMN Management Services have been defined and correspond to management services found in the PTN, then the PTN Management Service is based upon its TMN Management Service counterpart. Generally the functional changes required to introduce the TMN Management Service into a PTN environment are small, however in some cases these services may have been adapted to suit the PTN environment. In all cases the service definitions have been reviewed to remove non service-specific text so as to arrive at more concise descriptions etc.

In addition, some new management services have been introduced as part of PTN Management which do not (yet) have an equivalent TMN Management Service.

Below the origin and relationship of each PTN Management Service to the public service environment is outlined.

C.1   Name of Service: User aspects administration

Derived from similar ITU-T and ETSI versions, the name has been changed from "Customer administration" to suit the PTN environment. The description shows a logical and physical component to the users administration.

The impact of I-ETS 300 291, Functional Specification of Customer Administration on the OS/NE interface, needs to be considered.

C.2   Name of Service: Routeing administration

This has been derived from the TMN Management Service for Routeing and Digit Analysis administration which is similar in both ITU-T and ETSI. In a PTN environment routeing is generally considered a separate activity from handling dialled numbers. Any such activities would be incorporated as part of the PTN Management Service on Management of Dialling/Numbering Plans. However, the TMN Management Service does not hold any material specific to digit analysis and so the changes for the PTN Management Service description are minimal.

The impact of I-ETS 300 292, Functional Specification of call routeing information management on the OS/NE interface, needs to be considered.

C.3   Name of Service: Traffic measurement and analysis administration

This remains as it is in both ITU-T and ETSI - for further study.

C.4   Name of Service: Tariff and charging administration

The ITU-T version of this service is based upon the more advanced work of ETSI. This PTN version is similar to the ETSI version except that the need to consider managing pay-phone charging has been dropped.

C.5   Name of Service: Management of the security of PTN Management

This remains as it is in both ITU-T and ETSI - for further study.

C.6   Name of Service: Traffic management

The ITU-T and ETSI versions of this management service are almost exactly compatible. However both suffer from attempting to analyse the functional/physical partitioning of the service rather than concentrating on the perception of the service to the service user. The equivalent PTN Management Service tailors the terminology to a PTN Management environment and omits much of the analysis of how the service is distributed.

C.7   Name of Service: Management of PTN User Access

The name has been changed from "Management of Customer Access" to suit the PTN environment.

The ITU-T and ETSI versions of this management service are almost exactly compatible. However, both suffer from too much equipment detail and this has been omitted from the PTN Management Service. Further, the PTN version clarifies the distinction between this service and the physical aspects of the PTN Management Service for User aspects administration.

C.8   Name of Service: Management of Transport Networks

The name has been changed from "Management of circuits between exchanges and associated equipment (including transmission links)" to match changes made by ITU-T.

ITU-T seem to be taking the initiative on this management service by identifying the aspects comprising transport networks. The PTN version currently follows the ETSI text but plans to upgrade to the ITU-T text in the future. Both the ITU-T and ETSI versions include too much technology specifics and this has been removed from the PTN version.

C.9   Name of Service: Switching management

The ITU-T and ETSI versions of this management service are almost exactly compatible. However, both suffer from attempting to analyse the functional/physical partitioning of the service rather than concentrating on the perception of the service to the service user. The equivalent PTN Management tailors the terminology to a PTN Management environment and omits much of the analysis of how the service is distributed.

C.10   Name of Service: System installation administration

The name has changed to remove the " & network planning" part to match ITU-T.

This remains as it is in both ITU-T and ETSI - for further study.

C.11   Name of Service: QoS and Network Performance administration

This remains as it is in both ITU-T and ETSI - for further study.

C.12   Name of Service: PTN User Access to PTN Management

This service has been developed for the PTN environment but corresponds to the TMN Management Service "Customer controlled service". Currently the TMN Management Service is only in outline form and this PTN Management Service is expected to contribute to its development.

The PTN Management service also brings in aspects of the Service Profile Verification/Modification information model being developed by ITU-T

C.13   Name of Service: Restoration and Recovery

This remains as it is in both ITU-T and ETSI - for further study.

C.14   Name of Service: Management of PTN Network Services

This is a PTN Management Service which has not yet been identified by either ITU-T or ETSI for TMN. The service described is not exclusive to the PTN environment.

C.15   Name of Service: Management of Network Scenarios

This is a PTN Management Service which has not been identified by either ITU-T or ETSI for TMN. However, there is a strong relationship of this service with Management of Transport Networks where it can be seen as part of Bringing into Service and Restoration. This management service is likely to remain exclusive to the PTN environment.

C.16   Name of Service: Management of Dialling/Numbering Plans

This is a PTN Management Service which has not been identified by either ITU-T or ETSI for TMN. However, there is a strong relationship of this service with Routeing and Digit Analysis Administration. It is expected that this management service could also be applicable to the TMN environment.

C.17   Name of Service: Management of the PTN Management network

The name has been changed from "TMN Management" to suit the PTN environment. Both ITU-T and ETSI have this only marked down for further study. The text description given for the PTN environment is applicable to the TMN environment too.

C.18   Name of Service: PTN Signalling Management

This has been adapted from the ETSI/ITU-T service of "Common Channel Signalling System Management". Whilst there is much text in both the TMN descriptions of this service, it has been developed without reference to signalling needs in a PTN environment.

C.19   Name of Service: Supervisory Management Service

This is a PTN Management Service which has not been identified by either ITU-T or ETSI for TMN. However, there is a non-management feature developed by ETSI which this PTN Management Service emulates. The relevance for this management emulation outside of the PTN environment is not clear.

C.20   Name of Service: Management of Mobility

This is a PTN Management Service which has not been identified by either ITU-T or ETSI for TMN. The PTN Management Service is expected to be applicable to the TMN environment, however the impact of Global Service Mobility (GSM) work in ETSI is not yet clear.

C.21   Name of Service: Configuration of PTN Supplementary Services

This is a PTN Management Service which has not been identified by either ITU-T or ETSI for TMN. The PTN Management Service is expected to be applicable to the TMN environment.

C.22   Name of Service: Management of CSTA

This is a PTN Management Service which has not been identified by either ITU-T or ETSI for TMN. The PTN Management Service is expected to be generally applicable to the TMN/TASC environment.

Annex D

(informative)

Dependencies between PTN Management Services

It will always be the case that one person's complete job seems like only part of somebody else's bigger job. So it is with PTN Management Services. The list of services includes some services which are effectively comprised of other services. Identifying such relationships helps to put the PTN Management Services into scale and perspective.

The following list of interaction relationships can only encompass those PTN Management Services which are understood well enough.
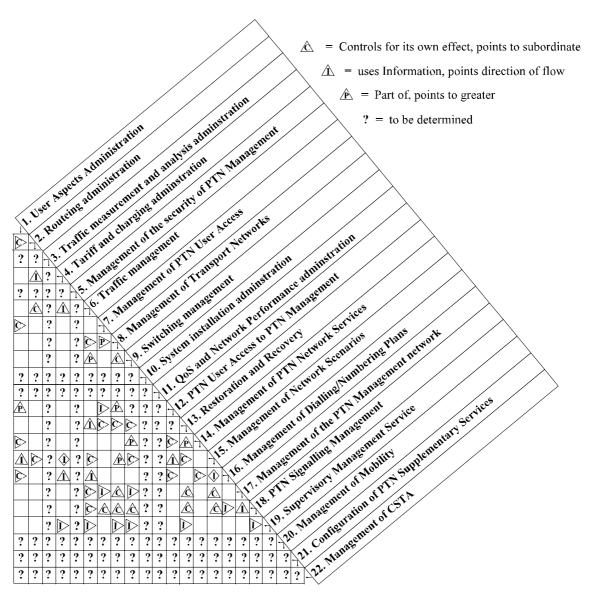
These are shown in table D.1 below.

Legend:
- △C = Controls for its own effect, points to subordinate
- △I = uses Information, points direction of flow
- △P = Part of, points to greater
- ? = to be determined

Table column headings (diagonal):
1. User Aspects Administration
2. Routeing administration
3. Traffic measurement and analysis adminstration
4. Tariff and charging adminstration
5. Management of the security of PTN Management
6. Traffic management
7. Management of PTN User Access
8. Management of Transport Networks
9. Switching management
10. System installation administration
11. QoS and Network Performance adminstration
12. PTN User Access to PTN Management
13. Restoration and Recovery
14. Management of PTN Network Services
15. Management of Network Scenarios
16. Management of Dialling/Numbering Plans
17. Management of the PTN Management network
18. PTN Signalling Management
19. Supervisory Management Service
20. Management of Mobility
21. Configuration of PTN Supplementary Services
22. Management of CSTA

Table D.1 - Dependence relationships between PTN Management Services

Annex E
(informative)

Management Service for the Management of PTN Network Services

E.1   Introduction

PTNs are more than just a collection of communicating PTNXs, by cooperating together they are able to offer services to the network user at a terminal access which appear to be independent of the individual nodes in the network. It is these services, referred to as NETWORK SERVICEs, which the terminal users of PTNs see and interact with; therefore it is essential that such services are effectively managed. To achieve such services, the network needs to be coordinated and this is achieved via the Service and Network Management Levels of the layering within the PTN management structure.

NETWORK SERVICEs are the logical coordination of the facilities offered by the system on each PTNX in the PTN. Thus, although these services appear to be independent of the PTNXs, they are in fact facades created by functional groupings (see ECMA-133) operating on each PTNX. The collection of these functional groups for a single PTNX will be referred to as its system facility. These groupings may be realised as combinations of equipment and software. A network user employs the capabilities offered by the NETWORK SERVICEs when interacting with the PTN.
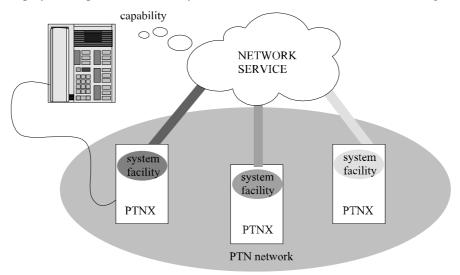

Figure E.1 - Illustration of logical to physical relationship for NETWORK SERVICEs as seen by a user of a PTN

Some examples of NETWORK SERVICEs are:

>   Basic Teleservices,
>   Supplementary Services,
>   Additional Network Features,
>   Directory Services,
>   Messaging Services.

Some of the functional groupings supporting the NETWORK SERVICEs are not normally visible to the network user. Notable here are redundant operations where the aim is to continue to support NETWORK SERVICEs despite failures in the underlying Facilities/support environment (i.e. equipment or software).

The Management Service presented in this Technical Report deals with managing the NETWORK SERVICEs (represented as managed objects at the service management level of PTN management) by the network authority so as to maintain the desired level of service to be provided to network users. Although conceptually many management

operations are performed on the logical NETWORK SERVICEs, the operations actually need to interact with the functional groupings in each PTNX in order to do this.

Thus at a practical level the management of the NETWORK SERVICEs takes place within each PTNX. In many cases the management of individual PTNXs needs to be orchestrated so as to achieve the desired effect at the logical Network SERVICE level.

The management of a NETWORK SERVICE at a PTNX level is analogous to the control of computer programs by a multi-tasking operating system. The computer operating system does not need to know the function of each program in order to manage it. In a similar way the functional group on each PTNX needs to be managed independent of the capabilities that the associated NETWORK SERVICE provides to the network user.

Typical management activities include the ability to recover from failures and the update of software. Such management activities must be provided by a function group in each PTNX and thus these management activities are themselves special cases of NETWORK SERVICE.

The management activities for NETWORK SERVICEs are categorized into two distinct services:

1) Protection Service, which provides redundant capabilities

2) Supervisor Service, which controls the operation of the facilities on each PTNX.

E.2. Task 1 - Describe Management Services for PTN Management

Management Services and Management Service Components

Name of Service: Management of NETWORK SERVICEs

Description:

Management of NETWORK SERVICEs covers all those functions necessary to bring into service and to keep in service the telecommunication capabilities provided by a PTN to a network user, including monitoring the performance of the Functional groups comprising a NETWORK SERVICE which provide such capabilities.

Where a component of service relates to a NETWORK SERVICE then this will require orchestration to coordinate the Functional groups comprising the service.

This PTN Management Service provides a framework for general use. Each instance is customised by a set of specific actions to cope with interworking issues between instances of this service.

Components of Service:

1. Performance measuring: involves the collection of data concerning the performance of a NETWORK SERVICE.

    • Continuous monitoring where the performance of the service is being constantly evaluated. This involves getting a continuous supply of performance data, either by demanding it or getting it to be reported on a tight schedule. The purpose of continuous monitoring is to keep a constant check on the performance of a service to verify that it meets a prescribed level.

    • Periodic monitoring where the performance is checked on a scheduled basis. This involves setting a schedule for reporting performance data. This procedure is required when a service, and/or its impact upon the network, needs to be gauged.

    • Threshold monitoring where performance problems of the service are reported by the network, and/or its impact upon the network, needs to be gauged. This is performance mechanism that would be used when the service and network are performing normally.

2. Bringing into service: involves testing all the Functional groups comprising a NETWORK SERVICE to ensure they are within the relevant specification and changing the state of the Functional groups to make them active.

    • Testing where the service is checked to ensure that it is operating within prescribed limits. Testing may be done implicitly via self-test procedures provided by the service or explicitly by checking responses to stimuli.

    • Initiate unblocking where a service which had been blocked from being available to the network is again made usable as a network service.

- Compatibility checks where the issue version designation of the service is checked to ensure that it is compatible with other services in the network. This is done when a new, or revised, service has been introduced to ensure that it will interoperate correctly with other services.

- Clock setting is done when a notion of time is crucial to the service's operation. This involves coordinating the time clock of the service in question to all other services to which it is related.

- Protocol testing is performed to verify that any protocols used by the service for communication are operating within prescribed limits. This may involve sending test messages and analysing the response and may require additional support equipment.

3. Alarm Surveillance: involves the collection of data concerning the degradation and failure of NETWORK SERVICEs without the customer's awareness. Also involved is the transmission of alarms and the results of automatic diagnostic tests.

   - Out-of-bounds checking where a service is checked for its reactions to defined out-of-bounds conditions. This may be done via internal self-test procedures or via a simulated service user. The latter case may require additional support equipment.

   - Continuous or periodic checking of function in a manner similar to Performance Monitoring.

   - Analysis of performance data where trends towards failure conditions may be detected.

   - Detection of error conditions as indicated by a performance threshold exception or an error report from the service itself. Additionally, associated service(s) may appear in error when the source is the (a common) associated service.

   - Periodic status prods involves eliciting a response from an otherwise dormant service to verify its operational status.

   - Alarm monitoring requires the service to report conditions which exceed defined alarm criteria. This involves the service testing abnormal conditions against those previously identified as heralding an alarm condition. Relevant information pertaining to the abnormal condition then becomes available for the alarm report. The actual details sent in the alarm report can be limited by management controls.

   - Alarm analysis involves using techniques to better reveal the true source of a failure. Such techniques may range from an alarm severity weighting coupled with a reporting delay, to the use of AI techniques. Typically the latter would require input from several alarm conditions to be analysed.

   - Non-intrusive testing to test the behaviour of a service without causing any perceived change in the service.

4. System protection: involves the change of state of PTNXs or the initiation of protection mechanisms with minimal degradation of service.

   - Initiate blocking to remove a service from active use by the network. This action may have consequences upon associated services.

   - Switchover to back-ups to preserve the perceived operation of the service by switching to a duplicate of the service. This involves ensuring that the back-up has all the significant operational data of the original at the time of switchover.

   - Restarts of a service to re-initialize it. This may cause some perceived loss of service by the network user.

   - Roll-backs where a service is taken back to a previous operational condition. This requires the condition to which to roll-back to has been previously recorded. This may result in some perceived service changes by some network users.

   - Hot stand-bys is associated with back-ups where operational information is being continuously passed between the active and stand-by versions of the service. With this component a switchover to back-up will involve the minimum of disruption to network users.

   - Reload is where the software comprising a service is reloaded from off-line storage. Typically this would occur when a software corruption is suspected.

5. Fault localization: involves the receipt of failure information, the initiation of additional localization techniques and the receipt of the results from such actions.

- Diagnostic testing requires the service to undergo extensive tests to evaluate its operational behaviour. Typically the service would need to be blocked from use whilst undergoing testing.

- Analysis of failure information is a post-dated form of alarm analysis.

- Trend analysis involves the use of AI techniques to detect behaviour trends which may be used to detect future failure conditions.

6. Fault correction: involves the replacement of the faulty part (software and hardware), if possible, the repair of the faulty part by a specialised repair centre.

- Component replacement involves physically replacing a component suspected of being faulty with an alternative. This will involve a temporary disruption in service while the component is replaced.

- Software patches is a technique where small changes to service software can be introduced without having to replace the whole software module.

- Restricting operational parameters when the behaviour scope of a service is restricted in order to prevent it encountering failure conditions.

7. Verification: involves the testing of the previously faulty functional group to ensure its correct functioning before making it active.

- Testing when a service is tested prior to ensure that it responds to prescribed test conditions in a normal manner.

- Trialing when a service is introduced in such a way as to only be available to selected users. These users, who may not be normal network users, would test the service under 'normal' operational conditions.

8. Restoration: involves changing the state of a System Facility(s) comprising a NETWORK SERVICE to make it active.

- Unblocking where a service is returned to normal operational status.

- Recover from protection state when a service which has been operated via a back-up is returned to its normal service provider.

- Data reconstruction occurs when the operational data controlling a service has to be reconstructed from stored information.

9. Configure a NETWORK SERVICE: involves changing the configuration of NETWORK SERVICEs by interaction with the Functional Groupings comprising the service.

- Control over optional aspects where the various operational controls made available by the service are adjusted to suit the needs of the network.

10. Withdraw a NETWORK SERVICE: involves making a NETWORK SERVICE unavailable for use.

- A timetable will indicate the conditions for the service to be withdrawn. This may be on a time basis but may also involve operational conditions (e.g. that the service is in an idle state).

Annex F

(informative)

Management Service for PTN User Access to Network Management

F.1   Introduction

Currently a user of a telecommunications network is predominantly dependant upon centralized management services to respond to his day-to-day needs. This can introduce significant delays, and even errors, in implementing the management requests on behalf of a network user. This puts a constraint upon the network user's interaction with the network which may stifle the user's full exploitation of the network's services.

As the move to the automation of basic management services gains pace it is envisioned that more management capability will be devolved to the network user in a controlled manner. This could relieve the loading upon the centralized management personnel and provide the user with greater control over his interaction with the network. To implement such an management service it is anticipated that the user's Terminal Equipment (TE) will need to achieve some of the capabilities of a workstation, or be linked to a device with such a capability.

An additional complication which needs to be reviewed is the possibility that a network user may have simultaneous access capability to multiple networks. In such cases it would be advantageous for the network user to experience the minimum of impact from such an arrangement.

The functionality required to support this service is expected to be based upon that provided for PTN management (itself based upon TMN) and will only require additional functionality in certain specific areas. This relationship to TMN/PTN Management is depicted in figure F.1 below:
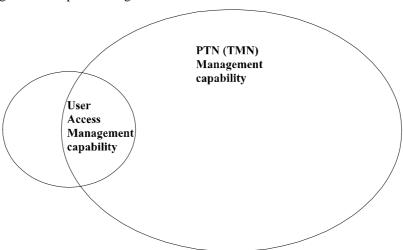

Figure F.1 - Relationship of functionality

The Management Service is described below.

F.2   Management by a PTN user

In this management service the user of the telecommunications network (or networks) being managed (i.e. the 'customer' at a TE) is allowed to interact with the management system of the network(s). This will enable the manageable aspects of the user's configuration to be accessed by the user directly and provide reports on network resources currently allocated to the user. Thus a network user may change his own configuration within the limits allowed by the authority responsible for the network. This may mean increasing or decreasing the range of network services available to him, subject to network performance/policy evaluations and with consequent billing arrangement amendments. The network user may also use this management service to report on calls associated with himself or to monitor information relevant to his network access or to gain access to information relevant to the user's account with the billing authority.

Functionally this will mean that the network user accesses the relevant Management Process (or Operations System) function within the management arena. This management function may be physically located (or just part of it) in (or associated with) the exchange to which the user has access. Alternatively the user may be routed to an external management function. Additionally the workstation function may be within the TE or accessed via the TE.
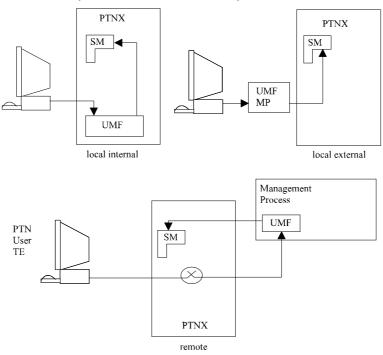

Figure F.2 - Examples of possible physical configurations

In the above figure F.2, UMF stands for User access to Management Function and is included to show how this management service may be implemented. The SM refers to the System Management function responsible for the PTNX to which the user is connected.

F.3 Access to the service

As this service enables management actions from a network user's access to the network then security is an important issue. Mechanisms must be available to ensure that the network user attempting to use the service is authorized to do so and is restricted in what can be done with the service.

NOTE F.1

The user interaction with this service is limited by the capabilities of the terminal equipment available at the access.

Access security will involve the human user as well as the TE in responding in an authorized manner to security interrogations. Such interrogations will occur at the start of the usage of this service, but may also occur periodically or following predefined events, all at the discretion of the network authority.

Limitations to the scope of the management areas available to the user via this service will be possible on an individual user basis. The range of available management areas will be identified in a 'template' which is agreed by the network authority. This template will also identify the limitations that the authority imposes on each management area for the user concerned. Management of the templates will be part of network management (Management of Security) and will not be accessible via the service proposed here.

Further security measures (e.g. encryption) will be at the discretion of the network authority but will not be specified further in this Technical Report.

For the purposes of this service the TE is restricted to local access and service is barred from an access which is remote from the PTNX offering the service. The local PTNX may interact with other management processes in order to provide the service requested by the user.

F.4   Service Perspectives

Principally, this management service is for use by PTN users and is described from such a user's perspective. However, the authority responsible for the network will also need to interact with this service and this thus forms a different perspective on the same management service. As a consequence, there are different service components associated with each perspective. These are depicted in figure F.3 below:
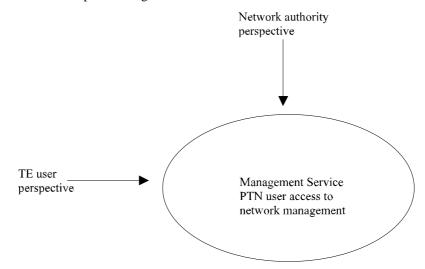

Figure F.3 - Differing perspectives

F.5   Components of Service

This section identifies some of the possible components that could go to make up this service.

F.5.1   User Perspective

F.5.1.1   Configuration Control

This gives the ability to view and modify the user's own configuration details within the limits proscribed by the network authority. Any changes will need to be verified as acceptable for efficient network operation (i.e. capacity, performance, performance loading, security etc.) and may have consequences for the user's billing account.

1. User's access configuration

The user lists and changes the configuration for his access within the limits allowed by the network authority. For mobile users the configuration for the access which is current for the user is unlikely to be changeable. However, the network authority may allow limited abilities to influence the access by nominated users.

Making up part of this component is Service Profile Verification and Management (being defined by ITU-T WP 5/11).

2. Reset user's configuration to the default set for the user

In case of difficulties, the user will need to be able to reset his configuration to a known state. This state will only be changeable by the network authority but will be viewed by the user before the reset procedure is started.

3. Schedule configuration changes of the user's access

For convenience it should be possible to allow the user to elect to have the changes made at a predefined time. It should also be possible for daily, weekly etc. patterns of changes to be set up for automatic implementation.

4. Report changes to the user's configuration not made by the user

The user must be kept informed of any changes to his configuration which he did not generate (e.g. changes to the limits of the user's management access). Normally this would be changes made by the network authority at the request of the user.

F.5.1.2   Service Management

From this component would be provided the ability for the user to interact with the network so as to set up personalised telecommunication services. Typically this would involve the user interacting with an Intelligent Network (IN) system which has the responsibility for providing non-trivial network services.

1.   List current services

Provides information on the current range of services available (directly or potentially) to the user.

2.   Change current services

Enables a user to change the range of services currently available to him within the limits proscribed by the network authority.

3.   Modify a service

Specific details relevant to the service (e.g. telephone numbers) may be changeable by the user.

4.   Add new services

A user creates a new service using the service functions as provided to him by the network authority. Typically this would involve combining pre-defined IN Service Functions to create a new overall service.

5.   Remove services

The user should have the ability to discard services associated with him. Additionally, the network authority will also need to be able to take a service away from a network user. However, the network authority will be able to define the minimum set of services which a user may specify.

6.   Test a service

Service testing has two aspects:

- For the network user to verify that the new service performs as expected. This may involve simulating the behaviour of the service under various network conditions.

- For the network authority to ensure that a new, or modified, service does not adversely impact the network performance. For this the network authority will need to be made aware when a new service is launched and to monitor its behaviour. In the event of major network failures any new services on trial should be removed from service.

1.   Cost out a service

Provides the user with information on the cost of existing or new services.

F.5.1.3   Call Monitoring

This provides details of calls currently associated with the network user.

1.   List current calls

This provides information on all the calls which are currently associated with the user by the network.

2.   List resources allocated

This provides information on all the resources which are currently associated with calls by the user.

3.   Report call statistics

This gives real-time information on calls in progress. The information may include:

- duration,
- hops,
- services employed,
- user data packets

etc.

1.   Display packet data

Gives details of user data packets sent via the B or D channel, giving type counts, errors, etc..

2. Display the capabilities of the destination terminal

If permitted and if the information is available to the network, it is useful for the user to determine the capabilities which a terminal connected to a call from the user would be prepared to offer to the call.

F.5.1.4 Access monitoring

This provides information/records of the management or network service dealings by the network user. A feature of this may be to provide a log of the sources of all unanswered calls to the network user.

1. List usage for management purposes

This provides information on the number of management interactions which have taken place with the user.

2. List usage for call purposes

Gives summary of normal calls to and from the user.

3. Give history of configuration changes

Lists changes made to the user's configuration and their source.

4. List/respond to unanswered calls

Provides information on calls to the user which have not been answered thus allowing the user to reply to them.

5. List failed calls

Gives known details of calls to or from the user which have failed. The range of failure reasons which will lead to calls being listed should be under the control of the user.

6. List errors report for the access

Details errors detected for the access to the user or errors reported against the user by other users trying to contact him.

7. Mark call as exhibiting an error

This allows the user to indicate to the management system that a particular call is behaving abnormal.

8. List diversions targeted

Gives information on PTN numbers which will divert/forward calls to the current user. The details should include the conditions for diversion and in the case of nested diversions it should identify the intermediate numbers who have diverted the call on.

F.5.1.5 Billing

This provides accounting information maintained by the network's billing authority for which the network user is allowed access. It may also involve changing personal details (such as the method of payment).

1. Give a running total

Gives costing information on a period, call type, duration, services etc. basis.

2. Cost of last call

Gives costing and other details for the last non-management call made by the user.

3. List account details

Gives details of the user's account as held by the billing authority.

4. List current tariffs

Provides the network and inter-network tariffs that currently apply.

5. List service tariffs

Provides the tariffs for the various services offered by the host network or others.

6. List/change payment methods

Enables the user an agreed degree of control over the payment mechanism for the billing account.

F.5.1.6   **Security**

Provides for the network user's control of the security arrangements applicable for his access. This may involve altering encryption keys etc..

1.   Password setting

The user's management access should be protected by a password mechanism under the control of the user. However, the network authority will need to retain a mechanism to reset the password to an agreed default. The network authority will also need a means of ensuring that the user periodically changes the password(s).

2.   Locking the user's access

This will enable the user to disable the part of the access over which he has control and thus prevent unauthorized usage.

3.   Setting encryption keys/mechanism

When transmitting encrypted data, the keys used by either end of the call will need to be coordinated. In addition there may be a choice of encryption mechanisms available.

4.   Invoking encryption

Automatic encryption may be invoked for call conditions defined by the user.

5.   Source confirmation

This involves checking via the management system to ensure that the Calling Line Identity provided by a call is valid and likely.

F.5.1.7   **CSTA**

Although not strictly part of management, the effects of Computer Supported Telecommunications Applications must be integrated into the interface provided to the network user.

F.5.1.8   **Testing**

Testing may involve testing of the user's access (more complicated when user mobility is allowed for) or test calls to network-provided test equipment.

1.   Loopback testing

Invokes loopbacks at various points in the user's access to enable transmission tests. The loopbacks may also be associated with a call associated with the user when loopbacks could be established at various points along the call.

2.   Connection to test equipment

Establishes a call to network provided-testing equipment so that the user's access may be tested.

3.   Call tracing

Provides information on the track taken by a call through the network. It should also provide historic information for the call, such as when forwarding has been applied.

F.5.1.9   **Directories**

The user will need access to directory information which is coordinated with the configuration changes made via any management source. In addition the user may be allowed to alter personal information within the limits prescribed by the directory authority.

1.   Access to directory information

The up-to-date directory information should be available to the network user.

2.   Changes to directory information

Where the directory information for non access-specific details for the user needs correction by the user concerned.

3.   Scheduled changes

Enables a directory change to be set up in advance (e.g. during a holiday period).

F.5.1.10   Network Status

This would be used to report on the conditions within the network which might affect traffic at the customer's access (e.g. problems with trunk routes, network congestion etc.).

1. Network loading

Provides details of the current state of overall loading of the network.

2. Trunk loading

Provides information on main trunk route loading and inter-network loading.

3. Anticipated delays

Information on the anticipated delays to call set-ups and packet data transmission is indicated. The packet delays will need to be categorized into the possible routes when connectionless transmissions are involved.

4. Alternative routeing currently in operation

Indicates the deviations from the normal routeing plan which is currently in operation. This information may have security/QoS/regulatory implications.

5. Inter-network loading

Indicates the available accesses to other networks and indicates their loading. It should also be possible to establish the loading on all inter-network accesses involved in establishing a call to destination terminal.

6. Congestion status

Provides an indication of how close the network or individual links are to being congested with traffic.

7. Bandwidth availability

Indicates the bandwidth available for the user's data traffic.

F.5.1.11   Help Desk

This enables the user to get expert advice on management aspects related to his access, and to query changes imposed upon his access by the authority responsible for the network. It will also allow requests to be made for management activities outside of the user's control.

1. User's configuration details

Provides details of the user to the help desk

2. User's permitted management access

Allows the help desk to examine the extent of management control which the user has available to him.

F.5.2   Network Perspective

This clause considers service components which are not available to the user of the service but instead are only available to the controller of the service (i.e. the network authority). However, these components are still very much part of the overall service as they are a consequence of the network user's interaction with the service.

F.5.2.1   Management Access Limitation

This gives control to the network authority of the extent of the management features allowed to a network user.

1. Place authorization triggers

It will be very difficult for the management authority to precisely define the extent of the user's management access with a full assurance of continued Quality of Service. However, by setting triggers it will be possible for the network authority to review any changes which may be of significance (i.e. outside a fairly limited bound based upon the user's default setting).

2. List/change the user's configuration

The network authority will need the ability to reverse the effects of any management actions which adversely affect the network's operation.

3. List/change the user's permitted management access

The extent of the user's management capabilities should be under the control of the network authority. This control may include the range configuration aspects as well as the value ranges for specific aspects.

F.6   Pictorial Description

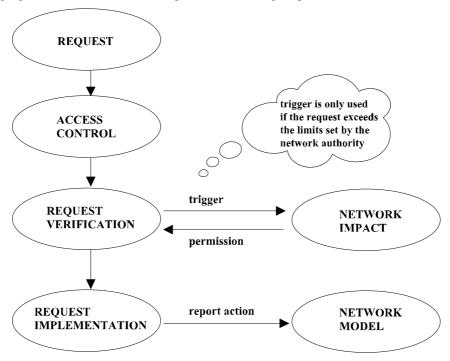The following figure illustrates how the management service might operate.

Figure F.4 - Illustration of service operation

F.7.   Additional considerations

Some further complications will have to be considered when developing this service:

1) The network user may be connected to several telecommunication networks. Despite this, the user may expect to have a unified interface and not expect to have to interact with each network individually. This may turn out to be a matter for the user's terminal rather than the interface.

2) A particular connection may pass through several distinct networks and thus this service will have to carefully consider its scope.

3) User mobility will cause problems of access security and scope of the service, i.e. with mobile users who has the responsibility for the user's access as the access being used may be frequently changed.

Annex G

(informative)

Management Service for Management of Network Scenarios

G.1   Introduction

The PTN Telecommunication function being managed by this Management Service is described in ECMA TR/65.

There are a number of possible distinct categories of scenarios for providing interconnections between PTNXs in a single PTN. These scenarios are outlined below.

Interconnected by:

1) Permanent Intervening Network Connections

Any number of pre-established channels or logical connections; groups of channels or connections may lead to different destinations (e.g. circuit/packet/frame switched or via ISDN signalling).

2) On-demand Intervening Network Connection

Any number of on-demand established channels or logical connections; groups of channels or connections may lead to different destinations (e.g. circuit/packet/frame switched or via ISDN signalling).

Within a PTN these scenarios may apply singly or in combination. This management service deals with the establishment of the interconnections between PTNXs as identified in these scenarios. Typically such activities only occur at the establishment of the network or when a change in its configuration occurs. Some of the scenarios, however, call for management involvement during network operation.

NOTE G.1

There is a strong relationship between this service and Management of Transport Networks where the Scenarios service can be seen as part of Bringing into service and Restoration. However, due to the complexities involved in managing scenarios and their restriction to PTN environments, it has been decided to develop scenario management as a separate management service.

Each scenario consists of two aspects:

a) The logical connections as required by the PTNXs,

b) The physical mechanism, to support this interconnection, supplied by the Intervening Network (IVN). The management requirements are only concerned with the mapping of the logical connections requirements onto the physical IVN mechanism.

For the logical interconnection this management service must be able to provide:

1) A means for both the interconnected PTNXs to refer to the same logical connection.

2) A frame of reference (e.g. number allocation scheme) by which each PTNX can refer to the same circuit (channel, time slot) as its counterpart in the connection.

3) A mechanism to ensure that the IVN is able to supply the most appropriate physical medium required to support the needs of the logical connection.

PTN Management will only be involved when permanent or on-demand scenarios are enabled. Typically PTN management will establish an initial connection to coordinate the mapping at both ends between the logical and physical perspectives.

G.2   Components of Service

1. Deciding on which scenario(s)

e.g. specification of communication mechanism to use according to conditions prevailing for calls.

2. Allocation of resources between scenarios

e.g. specifying which communication paths are appropriate for each communication mechanism possible.

3. Initialization and Testing

e.g. identification of communication capabilities, establishing coordinated physical to logical mapping, or associating QSIG with multiple IVN interfaces.

4. Optimization within scenarios

e.g. scheduled optimization to ensure the best use of resources on a time-of-day basis, or on demand due to network events.

The IVN may be under the responsibility of another network provider. This may cause occasions of reduced working of this service (at least automated working).

Annex H

(informative)

PTN Management Service on Metronome Synchronization

H.1 Description

The metronome (or 'clock') synchronization allows for coordinate timing of transmission bits. This management service deals with the optimization of the mechanics which provide metronome synchronization. As such it will normally act as a backup to a synchronization strategy which is implemented wholly within the PTN. However, in exceptional circumstances, it may be the only synchronization mechanism available to the whole PTN.

The service involves constructing a logical model of the synchronization strategy currently operating in the PTN (either at network initialization or during network operation) and being notified of changes to the strategy so that the logical model is kept up-to-date. By analysing the logical model (possibly in conjunction with other management information) it is possible to tell if the PTN is using the best metronome master(s) and/or if the route by which each PTNX accesses its master is optimal for the current operating considerations. From this analysis, the service will be able to instruct each PTNX so as to achieve optimized synchronization.

H.2 Components

1. Build a logical model of current PTN synchronization

2. Adjust logical model to changing PTN circumstances

3. Analyse logical model in conjunction with other fault or performance data

4. Adjust PTN to optimize network synchronization (using orchestration techniques)

5. Test PTN metronome synchronization

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