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SERIES M: TMN AND NETWORK MAINTENANCE:
INTERNATIONAL TRANSMISSION SYSTEMS,
TELEPHONE CIRCUITS, TELEGRAPHY, FACSIMILE
AND LEASED CIRCUITS

Designations and information exchange

Management of the grade of network maintenance services at the maintenance service customer contact point (MSCC)

ITU-T Recommendation M.1539

ITU-T M-SERIES RECOMMENDATIONS

TMN AND NETWORK MAINTENANCE: INTERNATIONAL TRANSMISSION SYSTEMS, TELEPHONE CIRCUITS, TELEGRAPHY, FACSIMILE AND LEASED CIRCUITS

Introduction and general principles of maintenance and maintenance organization	M.10–M.299
International transmission systems	M.300–M.559
International telephone circuits	M.560–M.759
Common channel signalling systems	M.760–M.799
International telegraph systems and phototelegraph transmission	M.800–M.899
International leased group and supergroup links	M.900–M.999
International leased circuits	M.1000–M.1099
Mobile telecommunication systems and services	M.1100–M.1199
International public telephone network	M.1200–M.1299
International data transmission systems	M.1300–M.1399
Designations and information exchange	**M.1400–M.1999**
International transport network	M.2000–M.2999
Telecommunications management network	M.3000–M.3599
Integrated services digital networks	M.3600–M.3999
Common channel signalling systems	M.4000–M.4999

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

ITU-T RECOMMENDATION M.1539

MANAGEMENT OF THE GRADE OF NETWORK MAINTENANCE SERVICES AT THE MAINTENANCE SERVICE CUSTOMER CONTACT POINT (MSCC)

Summary

This Recommendation provides the guidelines for the management of the Grade Of network[1] Maintenance Services (GOMS) at the Maintenance Service Customer Contact point (MSCC).

For any Maintenance Service (MS), the MSCC is a conceptual point at which a Maintenance Service Provider (MSP) and each of its Maintenance Service Customers (MSCs) can interact in order to provide, use, operate, measure, retain, manage, invoice, etc., the MS concerned according to the GOMS which has been established in a contract or in an informal agreement.

In this Recommendation, the following subjects are covered:

a)   the GOMS general aspects, from the point of view of an MSC and the point of view of an MSP requirements;

b)   the fundamental QOS criteria, methodologies, performance parameters, their indices and measurements, adopted for any MS and its Maintenance Service Elements (MSEs), including the associated set of maintenance processes and their specific procedures;

c)   the description of a consistent set of standardized Operational Procedures Selection for the management, achievement and improvement of the GOMS (OPSG) and the relevant main performance parameters/indices, which must ensure that for any MS and its individual network and service elements or any other support function [i.e. Operations, Administration Maintenance and Provisioning (OAM&P)], each process involved together with relevant procedures, are properly carried out and managed in order to completely achieve the agreed GOMS objective of this particular MS at the MSCC.

In the appendices, some examples of the application of an OPSG to specific managed areas regarding telecommunications services are also shown for a better understanding between an MSC and an MSP for any GOMS conformance testing. In a competitive market environment, for a specific end-to-end MS, the suggested guidelines will ensure the improvement of the efficiency and the effectiveness of all operational resources involved. The management of the GOMS also ensures to both MSC and MSP a significant optimization of all relevant operational costs.

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[1] The word "network" is used here to emphasize that the Maintenance Services are related to the entire telecommunication network and it will be avoided further within the text. A brief overview of the main Maintenance Services is shown in Annex A.

Keywords

Assessment of the grade of maintenance service, Grade[2] of maintenance service, Improvement of the grade of maintenance service, Maintenance service, Maintenance service availability, Maintenance service contract[3], Maintenance service customer contact point[4], Maintenance service customer, Maintenance service element(s), Maintenance service informal agreement[3], Maintenance service provider, Maintenance service unavailability, Management of the grade of maintenance service, Managed area (telecommunications service involved), Quality of service.

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[2] For the purpose of this Recommendation the terms "grade of service", "service level" and "service performance" are similar.

[3] For any MS, the definition is reported in Recommendation M.1537.

[4] For a generic service, the term "Service Access Point (SAP)" is often used.

FOREWORD

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

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

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

NOTE

In this Recommendation the term *recognized operating agency (ROA)* includes any individual, company, corporation or governmental organization that operates a public correspondence service. The terms *Administration, ROA* and *public correspondence* are defined in the *Constitution of the ITU (Geneva, 1992)*.

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CONTENTS

Page

Recommendation M.1539

MANAGEMENT OF THE GRADE OF NETWORK MAINTENANCE SERVICES AT THE MAINTENANCE SERVICE CUSTOMER CONTACT POINT (MSCC)

(Geneva, 1999)

1   Scope

This Recommendation provides the guidelines for the management of the Grade Of Maintenance Services (GOMS) at the Maintenance Service Customer Contact point (MSCC). The GOMS is an integral part of a contract or an informal agreement between a Maintenance Service Provider (MSP) and a Maintenance Service Customer (MSC).

This Recommendation specifies:

a)   the GOMS general aspects, taking into consideration both the MSC and the MSP requirements of such services, together with all existing references and the definition of new concepts and terms;

b)   the fundamental QOS criteria, methodologies, performance parameters, their indices and measurements, adopted for any MS and its Maintenance Service Elements (MSEs), including the associated set of maintenance processes and their specific procedures;

c)   the description of a consistent set of standardized Operational Procedures Selection for the GOMS management (OPSG) and the relevant main performance parameters/indices, which must ensure that for any MS and its individual network and service elements or any other support function [i.e. Operations, Administration, Maintenance and Provisioning (OAM&P)], each process involved together with relevant procedures, are properly carried out and managed in order to completely achieve the agreed GOMS objective of this particular MS at the MSCC.

This Recommendation does not specify:

a)   any particular value/target for performance indices being agreed in a GOMS applied between an MSC and an MSP;

b)   any specific OAM&P process and relevant procedures implementation implication being applied for the assessment, management and improvement of the GOMS (e.g. particular internal organization for both MSC and MSP);

c)   performance indices for any specific MS.

2   References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations listed below. A list of the currently valid ITU-T Recommendations is regularly published.

–   ITU-T Recommendation E.440 (1996), *Customer satisfaction point*.

–   ITU-T Recommendation E.800 (1994), *Terms and definitions related to quality of service and performance including dependability*.

– ITU-T Recommendation G.821 (1996), *Error performance of an international digital connection operating at a bit rate below the primary rate and forming part of an integrated services digital network.*

– ITU-T Recommendation G.826 (1996), *Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate*.

– ITU-T Recommendation I.610 (1999), *B-ISDN operation and maintenance principles and functions.*

– ITU-T Recommendation M.60 (1993), *Maintenance terminology and definitions.*

– ITU-T Recommendation M.1230 (1996), *Method to improve the management of operations and maintenance processes in the international telephone network.*

– ITU-T Recommendation M.1530 (1999), *Network maintenance information.*

– ITU-T Recommendation M.1535 (1996), *Principles for maintenance information to be exchanged at customer contact point (MICC).*

– ITU-T Recommendation M.1537 (1997), *Definition of maintenance information to be exchanged at customer contact point (MICC).*

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

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

– ITU-T Recommendation X.739 (1993) | ISO/IEC 10164-11:1994, *Information technology – Open Systems Interconnection – Systems Management: Metric object and attributes*.

3 Abbreviations and acronyms

This Recommendation uses the following abbreviations:

ATM	Asynchronous Transfer Mode
ATM PVC	Asynchronous Transfer Mode Permanent Virtual Circuit
BER	Bit Error Rate
EI	maintenance service Element performance Index
ES	Errored Seconds
GOMS	Grade Of Maintenance Service
ISDN	Integrated Services Digital Network
ISO	International Organization for Standardization
LCS	Leased Circuit Service
MICC	Maintenance Information to be exchanged at the Customer Contact point
MS	Maintenance Service
MS/GOMS	The GOMS related to a specific MS
MSAV	Maintenance Service AVailability
MSC	Maintenance Service Customer
MSCC	Maintenance Service Customer Contact point
MSE	Maintenance Service Element

MSP	Maintenance Service Provider
OAM&P	Operations, Administration, Maintenance and Provisioning
OPSG	Operational Procedures Selection for the management, achievement, and improvement of the GOMS
PI	Process performance Index
PrI	Procedure performance Index
RFMS	Ready For Maintenance Service/Grade Of Maintenance Service date
RFS	Ready For Service[5] date
SDF	Service Degradation Factor
SES	Severely Errored Seconds
TMN	Telecommunication Management Network
TPMS	Time to Provide a Maintenance Service/Grade Of Maintenance Service
TRMS	Time to Restore a Maintenance Service/Grade Of Maintenance Service
UNAV	UNAVailability
US	Unavailable Seconds

4 Terms and definitions

Terminology and definitions relating to this Recommendation are provided in Recommendations M.60, M.1230, M.1535, M.1537, E.440 and E.800.

This Recommendation defines the following terms:

4.1 Grade Of Maintenance Service (GOMS): A set of specified performance indices regarding appropriate service quality parameters relevant to each of the identified process of all MSEs pertaining to a specific MS, which are used to provide a measure of the conformance of an MS as required by an MSC and offered by an MSP. The agreed GOMS are generally specified as the success probability to obtain the agreed performance values or limits range as defined in the MS contract or in the informal agreement between an MSP and an MSC for that specific MS.

4.2 Maintenance Service (MS): That which is offered by an MSP to any customer, in order to satisfy its specific requirements of a telecommunications service, at the Maintenance Customer Contact point (MSCC). An MS can be considered as a specific combination of service functions or a set of uniquely identifiable and definable network and service elements (OAM&P functions), including any other facilities as needed, to set up, support, retain and manage telecommunications services.

4.3 Maintenance Service Customer (MSC): A general reference to an entity that uses an MS from an MSP on an agreement basis. An MSP could be an MSC of another MSP. In the same way, a network operator may be an MSP.

4.4 Maintenance Service Customer Contact point (MSCC): For any Maintenance Service (MS), the MSCC is a conceptual point at which a Maintenance Service Provider (MSP) and each of its Maintenance Service Customers (MSCs) can interact in order to provide, purchase, operate,

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[5] This term and its abbreviation are normally used for a generic service.

measure, retain, manage, invoice, etc., the MS concerned according to the Grade Of Maintenance Service (GOMS) as established in the contract or in the informal agreement they have stipulated.

4.5 **Maintenance Service Elements (MSEs)**: A set of appropriate and generally distinct network and service supporting resources[6], including any OAM&P technical and commercial functional supports at disposal of the MSP, intended to provide, support, operate, measure, maintain, manage the whole MS concerned, according to specific processes and any particular characteristic of that MS, at the MSCC. Each of the MSEs has its own performance. Therefore, the whole performance of an MS (i.e. its GOMS) is an adequate combination of the performance results of all its involved MSEs[7].

4.6 **Maintenance Service Provider (MSP)**: A general reference to an entity that provides an MS to customers on a contract basis.

4.7 **Operational Procedures Selection for the management, achievement and improvement of the GOMS (OPSG)**: An agreed selection of operational procedures from a large group, negotiated between an MSC and an MSP. This set ensures the management, achievement and improvement whenever it is needed of an agreed GOMS and it may be or not included in the contract or in the informal agreement.

5 Maintenance Services (MSs) and relationship with the telecommunications-managed areas

Nowadays, in a competitive telecommunications scenario of multi-service providers, the QOS management oriented towards customer's expectations and satisfaction has created significant changes in all telecommunications-managed areas and relevant service management needs. This multiple-service providers situation exists now also in the "maintenance domain and all relevant services". For example, the presence of multiple-service providers in all the existing switched telephone services, mobile communications services, switched data services, private leased circuit services, intelligent network services, ISDN services, ATM services, etc., imply specific needs for all the associated network maintenance activities and their end-to-end performance management. An MS is a particular service which is offered by an MSP to its MSC(s) in order to satisfy all its business/commercial, technical and administrative service requirements related to the provisioning, the maintaining and the managing of a specific telecommunications service at an access point which is a conceptual point called a Maintenance Service Customer Contact point (MSCC). At this point any MSC and an MSP of a particular MS can interact for any management needs involved by this MS.

Any of the identifiable MS concerned, in practice, can be considered as an adequate combination of a set of Maintenance Service Elements (MSEs) which need to be clearly defined, operated and managed in order that the MS can be effectively offered by an MSP and used by an MSC.

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[6] The expression "network and service supporting resources" is usually simplified as "network and service resources" within this Recommendation.

[7] A suitable exchange of information is usually related to each of these MSEs. The basic MICC concepts and related definitions are reported in Recommendations M.1535 and M.1537.

6 Outline description of the management of the Grade Of Maintenance Service (GOMS) at the Maintenance Service Customer Contact point (MSCC) and its reference model

For a specific MS, in general the Grade Of Maintenance Service (GOMS) is an appropriate set of performance indices regarding a certain amount of quality parameters. Each of these is related to a set of MSEs constituting the involved MS. These MSEs performance Indices (EI) are related to a certain amount of well-identified operational processes and relevant procedures having their performance indices, that is PI and PrI.

Taking into consideration the overall quality of an MS, its GOMS as agreed between an MSC and an MSP represents a powerful tool for managing the required grade at the MSCC. The GOMS may be used to provide a measure of the conformance of an MS as required by an MSC and offered by an MSP at the MSCC.

It is to be emphasized that, for a specific required/offered MS, appropriate Quality Of Service (QOS) criteria, methodologies and relevant parameters/indices have to be established in order to:

a)   fulfil the MSC requirements;

b)   achieve, maintain or improve when required the GOMS of an MS;

c)   allow an MSC to make, for the same type of MS offered by different MSPs, an objective comparison between each of the GOMS offered by individual MSPs.

For an efficient management of the agreed GOMS it is necessary to establish an adequate Operational Procedures Selection (OPSG) which contains a well-defined amount of basic processes and relevant procedures among which the fundamentals are:

1)   the collection of all parameters/procedures included in any of the identified MS process and relevant performance indices measurements and limits thresholds which define the proper functioning state;

2)   the recording of all data in order to monitor and analyse the trends of all performance indices concerned;

3)   reporting of data, that is, any information as needed which will be exchanged between the MSC and the MSP in order to jointly assess the achievement or the improvement of the agreed GOMS.

Considering the above OPSG objectives, it is of primary importance for both MSC and MSP to set up and manage any internal and external interface procedure as needed.

The main benefits that an MSP will derive through the management of the GOMS are the following:

•   optimization of the internal organizational structure to reply properly to any MSC requirement for a specific MS;

•   for any MS, appropriate choice and systematic update of its own performance indices which are used to monitor and manage every MSE, its processes and relevant procedures.

As regards the relationship involved between an MSC and an MSP for the management of the GOMS, this implies a systematic and objective monitoring, the measurement of all identified performance indices of any offered MS and its individual MSE concerned. Therefore, from an operational point of view the best way to proceed for both an MSC and an MSP is to follow-up and update all standardized operational procedures once the overall agreed GOMS has been signed in a contract or in an informal agreement.

Figure 1 shows the reference model for the management of the GOMS. A specified GOMS is agreed between an MSC and an MSP regarding an MS provided by the MSP at the MSCC. Within the MSP, in order to manage the agreed GOMS, an OPSG may or may not be determined as part of the agreement. The OPSG consists of MSEs associated individually with their own performance index (EI). Each MSE consists of several processes associated with performance indices. Each process consists of several procedures associated with performance procedure indices. These procedures produce MSE specific functions. Each performance index is monitored through its conformance to a specified limit. Appropriate procedures shall be regularly and carefully applied to maintain the agreed GOMS.
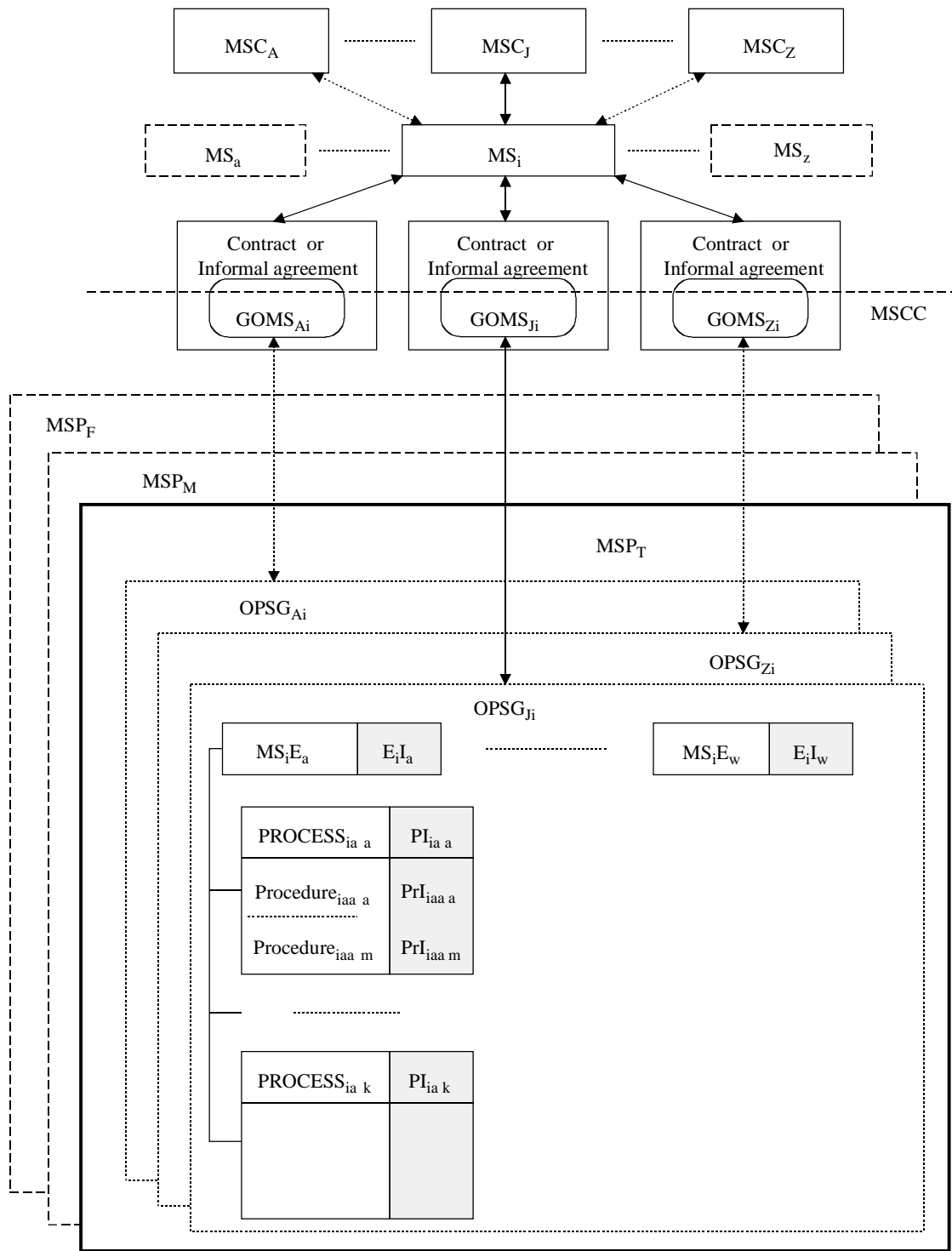
MSC	(from A to Z)
MS	(from a to z)
GOMS	(from A_i to Z_i)
MSP	(from F to T)
OPSG	(from A_i to Z_i)
MSE	(from a to w)
PI	(from a to k)
PrI	(from a to m)
EI	(from a to w)

Figure 1/M.1539 – Reference model for the management of the GOMS

7 GOMS states and concepts of "acceptable" and "unacceptable"

In order to achieve a common understanding between an MSC and an MSP and clearly identify the actual GOMS state, two distinct states are defined: "acceptable" and "unacceptable".

The following concepts are used:

1) Acceptable state – The GOMS fulfils the overall objective as agreed in the contract or in the informal agreement. This means a situation better than or equal to the agreed limit.

2) Unacceptable state – The GOMS does not comply with the overall objective as agreed in the contract or in the informal agreement.

Figure 2 shows the GOMS states and the limit.

GOMS limit   T0409020-98
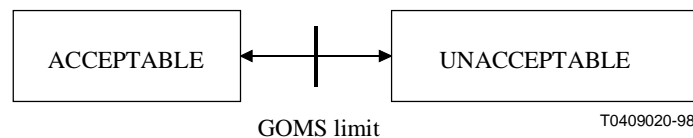
Figure 2/M.1539 – GOMS states

8 Maintenance Service Customer (MSC) expectations for the GOMS

The main MSC expectations for any MS to which it will subscribe are the following:

a) optimization of the performance and cost of the MS;

b) clear definition of all advantages obtainable, through a common understanding of any general technical and non-technical issues related to the MS;

c) simple verification of the achievement of the foreseen advantages and consequently to have the possibility to make an easy selection of the MSP(s);

d) systematic review and easy comparison between the expected and the achieved quality of an MS;

e) agreed GOMS. This implies the definition of specific grade states and associated parameters for which appropriate performance limits or thresholds must be specified in a contract or in an informal agreement of the MS concerned;

f) more reliable quality data of the involved MS, that is, more transparent exchange of information with the MSP, and as a consequence a more objective utilization of any "ad hoc" programme finalized to restore or improve the agreed GOMS of the MS concerned;

g) prompt, easy, reliable and secure access to the MSCC to carry out any type of activity regarding the GOMS (e.g. to notify and follow up any quality problem impacting the MS, obtain/exchange any type of current or past information/data on GOMS);

h) prompt and efficient coordination by all MSPs involved in its MS to carry out any activity to achieve the agreed GOMS objective or any specified quality target as deemed necessary.

9 MSC requirements for the GOMS

Once the MSC expectations for a specific MS become actual clauses and they are specified and signed in a contract or in an informal agreement with an MSP, these expectations represent its effective/agreed requirements. In general, these MSC requirements can be either independent of the type of MS or its characteristics which are usually related to the relevant telecommunications

purposes (i.e. communication service required), or they can be strictly dependent on this MS type or these characteristics.

9.1   MSC requirements and goals independent of the characteristics of the MS

The main customer's requirements which are independent of the type or the characteristics of an MS are as follows:

a)   Specified/agreed degree of accessibility, exchange of information and security to all MS capabilities and any network and service supporting/interfacing facility at the MSCC. For example:

  1)   contact time: 24 hours/day over 365 days per year;

  2)   different means of communication to access the MSCC (e.g. telephone, facsimile, email);

  3)   continuous, reliable and full access to browse through all historical and current MS/GOMS data, including the ability to insert, change, or remove controls, or to interact with any network element in any way and the ability to insert, modify, or delete GOMS reference data and the relevant MSEs performance indices thresholds or any other parameter. Examples of the above information are: MS start date; number and type of the contract, start, end and duration of all MS/GOMS unavailable/unacceptable states including relevant causes or any other impairment or outage with the relevant localization details.

b)   Specified/agreed way how to access the efficiency of the MSP for all needed MS, in terms of:

  1)   no shift for the Ready For Maintenance Service/GOMS date (RFMS) when it is contractually agreed;

  2)   time to restore the GOMS/MS, in case the GOMS is in an unacceptable state and also the MS is unavailable, not exceeding a certain limit, in order to ensure that the overall Maintenance Service Availability (MSAV)[8] is retained within the agreed contractual value;

  3)   specified/agreed time of intervention in the presence of particular events or needs for assistance (e.g. an efficient coordination and prompt actions from any MSP which is involved in MS Provisioning of an entire end-to-end LCS).

The main MSC goals which are independent of the type or the characteristics of an MS are the following:

a)   to maintain as far as possible the same characteristics of the MS speed, availability, reliability, security, simplicity, flexibility etc., for any access or request of response to the MSP at the MSCC;

b)   to obtain immediately any type of new feature and support from the MSP whenever new MS needs are identified at the MSCC;

c)   to achieve the best cost margin for any used MS and relevant agreed GOMS.

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[8]   The main concepts and calculation formula of the MSAV are shown in Annex B.

9.2 MSC requirements and goals dependent on the characteristics of the MS

The main MSC requirements which are dependent on the type of characteristics of an MS and therefore are similar or may be correlated to the telecommunication services (see Notes 1 and 2), are as follows:

1)   MSAV for any agreed MS;

2)   performance assessments (measurements and evaluations) of all agreed parameters;

3)   performance specifications for any involved MS, its component MSEs and any process/procedure (i.e. the establishment of appropriate thresholds or targets) in order to ensure that the agreed MS is set up, operated and managed correctly at the agreed GOMS.

NOTE 1 – Examples of these MSs are: MS Provisioning, for voice and non-voice services, for private leased circuit services, frame-relay PVC service, digital non-switched service such as ATM PVC.

NOTE 2 – Examples of performance parameters/indices are: BER, ES, SES, US, ATM cells loss ratio.

The main MSC goals depending on the type or characteristics of an MS are:

1)   conformance achieved in all scheduled GOMS assessments/testing/measurements of the operational performance indices regarding each technical parameter as specified in the contract or in the informal agreement of any MS with the MSP. This conformance is required for each of the involved national and/or international standards related to all network and service supporting resources;

2)   immediate update of the above limits or thresholds of the performance indices according to any change of the national and/or international standards or a particular request;

3)   reuse as far as possible of the same hardware and software capabilities and the existing facilities for any required change which might involve only the MS capacity extension (e.g. in terms of number/volume of specific planned activities).

10   GOMS methodology for a Maintenance Service Provider (MSP)

This clause describes the methodology adopted by an MSP in order to satisfy the requirements related to the agreed GOMS.

For any offered MS, an MSP has to manage an appropriate amount of network and service resources in order to ensure the achievement of the agreed GOMS. The performance criteria related to these resources have to be established and managed. The performance parameters can be either independent of the type or characteristics of the involved MS and relevant GOMS [e.g. Time to Provide an MS/GOMS (TPMS) and Time to Restore an MS/GOMS (TRMS)], or dependent on the type or characteristics of the MS concerned. These characteristics may be correlated in different way to specific parameters/indices of the communication service for which the MS itself is used (e.g. delay, BER, US, SES).

In order to reach the agreed GOMS objectives and/or any relevant target, an MSP has to set up any type of suitable resources. The most important are:

a)   a complete catalogue of offered MSs, with relevant features, options and prices;

b)   adequate capability, including any type of process management in order to demonstrate compliance with any existing standard as well as the possibility of upgrading;

c)   appropriate systems for data collection, network monitoring and management purposes.

A typical life cycle model, which is quite generic and applicable to any MS, can be used by an MSP and it is shown in Figure 3. The GOMS planning phase consists of building up an operational procedures selection in order to achieve a specific GOMS which will be later offered to an MSC.

This phase is followed by GOMS provisioning which terminates with the establishment of an adequate OPSG. At this time both the GOMS assessment and measurement start. A GOMS measurement step ends with an adequate corrective action.

GOMS Planning	GOMS Provisioning	GOMS Measurement	
GOMS set-up agreement	Resources ready	OPSG ready Assessment start	Corrective action for GOMS indices

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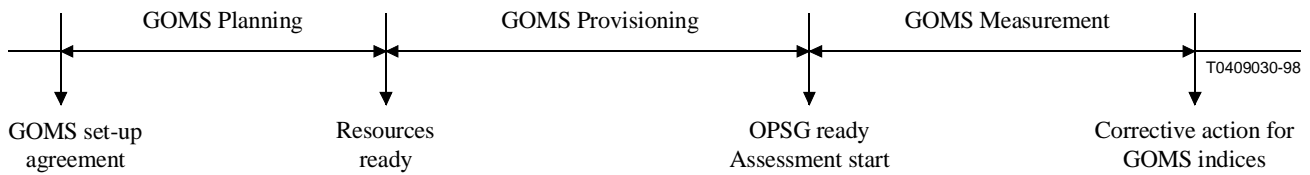
Figure 3/M.1539 – Typical life cycle model for the management of the GOMS

It is important to underline that the efficient management of the GOMS is one of the main objectives for the MSP. To reach a specific GOMS or any target as agreed with its MSC, the MSP must carry out, on an ongoing basis, every performance monitoring and management activity regarding any MSE and its processes/procedures or any other involved resource. In this way, the MSP will be able to immediately find out, within the applied OPSG, any network and or service component/resource which is not performing in accordance with the established standard. Afterwards it can activate the most suitable way to avoid that the GOMS becomes unacceptable or when it is already unacceptable, the MSP must ensure that this state does not last long enough to produce serious problem of unavailability to the MS itself.

10.1   Goals of an MSP for the offered GOMS

The OPSG setting-up and continuous verification to ascertain its permanent validity and ongoing operability of all relevant procedures is a goal of primary importance for the MSP. For any offered MS, the MSP shall reach a certain GOMS as agreed with its MSC in a contract or in an informal agreement. To ascertain the efficiency of the applied OPSG, the MSP usually carries out the assessment of a certain number of performance parameters and relevant indices which are strictly related to the specific components of this OPSG. Among these parameters the most important are:

1)   availability of MS/GOMS at the MSCC (see Note);

2)   TPMS for MS/GOMS at the MSCC (see Note);

3)   successful MS/GOMS Provisioning rate at the MSCC (see Note);

4)   time for MS/GOMS monitoring and reporting at the MSCC (see Note);

5)   TRMS for MS/GOMS at the MSCC (see Note).

NOTE – For the definitions of this parameter, see Table 1.

10.2   Relationship with an MSC for the GOMS requirements independent of the MS characteristics

Relationships with an MSC which are independent of the type of MS are those related to OAM&P criteria and to the corresponding requirements as described in 9.1.

The main involved parameters are: TPMS, TRMS, etc.

As a general approach, an MSP has to assure one unique and clear output for data sent to the MSC, even if the overall process may involve many various aspects and different internal entities in the management of the offered service.

The MSP has also to provide facility for promptly accepting requests coming from the MSC, for instance requests for service upgrades which will become available with new technology.

Relationships with an MSC should be based on formal reporting going toward both directions.

From the physical point of view, the MSC/MSP interface may be implemented by a call centre, a data interface or a human-machine interface on video terminal.

10.3 Relationship with an MSC for the GOMS requirements dependent on the MS characteristics

Relationships with an MSC which are dependent from the type of an MS are those related to performance parameters and, more generally, to its requirements described previously in 9.2. An MSP shall take into account that the GOMS is mainly determined by the consistency, the efficiency and effectiveness of all its interactive processes with the MSC. All these processes must be characterized by an appropriate exchange of data for each type of MS. These data shall be derived from evaluation procedures and/or measurements of all MS network and service performance characteristics.

Some examples of the main telecommunications services for which specified measurements have to be carried out, collected, recorded and reported on a systematic basis are:

a)   Leased Circuit Services (LCS);

b)   ATM cell relay service;

c)   frame-relay PVC service;

d)   analogue PVC services.

11 Main performance parameters/indices for the assessment, management and improvement of the GOMS

In order to assess, manage and improve the GOMS, it is important to establish both a minimum set of performance parameters/indices and the measurement and evaluation criteria to be used at the MSCC. This information for each MS shall be clearly described and agreed in the contract or in the informal agreement between an MSC and MSP.

The minimum set of performance parameters and indices, the measurement and evaluation methods are described in the following paragraphs.

Figure 4 shows a general flow diagram for the assessment, management and improvement of the GOMS. GOMS objectives as well as their performance indices are agreed between an MSC and MSP in order to assess continuously the conformance to the agreed values/levels. When a difference (Δ) between the assessments of the GOMS as carried out by an MSP and an MSC exists, a feedback shall be immediately sent to the GOMS provisioning functional element in the assessment chain in order to activate any corrective action as deemed necessary. This will allow the elimination of any possible quality problem, thus maintaining the agreed GOMS.
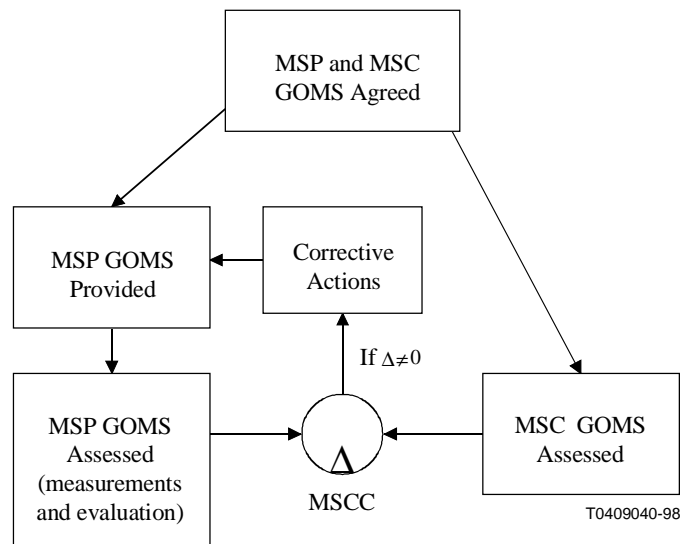
**Figure 4/M.1539 – Flow diagram for the assessment, management and
improvement of the GOMS**

11.1 Minimum set of performance parameters/indices for the GOMS and relationship with the type of MS

The minimum set of performance parameters/indices which characterize or contribute to the GOMS shall be established taking into account the MSC requirements for a specific MS. There are two main types of performance parameters and relevant indices to be considered:

a)   *GOMS performance parameters/indices independent of the specific type of the MS*

It is to be noted that these performance parameters/indices are also strictly related to the specific business strategies and market orientation of an MSP and an MSC. They can easily be utilized to get a typical evaluation of the efficiency of an MSP for the offered MS. The main GOMS performance parameters/indices related to this category are shown in Table 1. It is to be noted that in this table the GOMS and the MS are jointly written to emphasize the strong relation which exists between the overall GOMS and the relevant MS or vice versa. This relation quite often implies that an acceptable/unacceptable state for the GOMS corresponds or implies a contemporaneous MS available state/complete outage and then its availability/unavailability at the MSCC.

Table 1/M.1539 – Main MS/GOMS performance parameters/indices independent of the specific type of the MS (see also Notes 1 and 2)

	Performance parameter	Performance indices
1)	*Time for MS/GOMS provisioning (TPMS) at the MSCC* Start: MS/GOMS contract signed. End: MS/GOMS accepted by MSC. – The time is necessary to provide the MS as agreed in a contract or in an informal agreement and the management of the agreed GOMS can start. – This is a measure of the efficiency of both the MSP and the MSC for MS/GOMS provisioning.	Meantime to provide MS/GOMS.
2)	*Successful MS/GOMS provisioning rate at the MSCC* – Probability that MS/GOMS provisioning is successfully completed or the MS can be successfully used by the date/hour agreed in a contract or in an informal agreement (i.e. the RFMS) and its agreed GOMS is in an acceptable state.	Mean and absolute number of times the MS can be used by the agreed date/hour (i.e. the RFMS) and its GOMS is in an acceptable state with respect to the total number of MS/GOMS provisioning requests.
3)	*Lead time to provide MS/GOMS at the MSCC* Start: MS/GOMS ready to be used at the agreed date/hour as specified in a contract or in an informal agreement. End: MS/GOMS ready and MSC acceptance.	Meantime to lead an MS/GOMS.
4)	*Availability of an MS/GOMS at the MSCC* – The available/acceptable state of MS/GOMS at a certain instant of time or the percentage of time an MS/GOMS is available/acceptable over a period of time of agreed use/duration of the MS/GOMS or required absence of unavailable/unacceptable states. – It is a measurement of the time an MS is available for use as agreed in a contract or in an informal agreement and its GOMS is in an acceptable state at the MSCC. – This measurement is the complement of MS/GOMS outage/unacceptable state duration time.	Mean and absolute outage time of an MS with unacceptable state of its GOMS.
5)	*Time for MS/GOMS monitoring and reporting at the MSCC* Start: MS/GOMS monitoring starting. End: MS/GOMS reporting completion. – The promptness and capability to monitor and report MS/GOMS availability state and acceptable state respectively, at the MSCC.	Mean and maximum/minimum time to report MS/GOMS state.

Table 1/M.1539 – Main MS/GOMS performance parameters/indices independent of the specific type of the MS (see also Notes 1 and 2) *(concluded)*

	Performance parameter	**Performance indices**
6)	*Time to restore MS/GOMS (TRMS) at the MSCC* Start: unavailable/unacceptable MS/GOMS. End: MS/GOMS accepted by MSC. – The time is necessary, after the occurrence of an MS outage(s) and the GOMS is in an unacceptable state(s), to restore the MS in a state where it can be reused and the GOMS becomes again acceptable as agreed in a contract or in an informal agreement. – This is a measure of the efficiency of both the MSP and the MSC for MS/GOMS restoration. – The measurement of TRMS may be based on MSC notification or acceptable service.	Mean and maximum time to restore MS/GOMS in an available/acceptable state.
7)	*Efficiency of operational activities for MS/GOMS at the MSCC* – The ease and convenience of all means (e.g. telephone, facsimile, email) utilized by the MSC and MSP to carry out any OAM&P activity regarding MS/GOMS at the MSCC.	Mean and maximum number of notified and recorded problems and their duration time to manage any MS/GOMS operational activity.
8)	*Security for MS/GOMS data at the MSCC* – The overall degree of privacy and confidentiality for MS/GOMS data (i.e. inaccessibility/unavailability of MS/GOMS data due to either privacy violation or lack of protection in any used resource). – The conformance to a specific data security grade/level as agreed in a contract or in an informal agreement between the MSC and the MSP. – This is a measure of the robustness of both the MSC and the MSP for data security purposes.	a) Mean and absolute number of times it is notified and proven that an MS/GOMS data problem due to security exists. b) Mean and maximum time it is notified and proven that an MS/GOMS data problem due to security exists. c) Mean and maximum time to restore security of MS/GOMS data after the occurrence of an MS/GOMS outage/unacceptable state due to security problems.
9)	*Billing integrity for MS/GOMS data at the MSCC* – The overall conformance of billing data to the specific grade/level as agreed in a contract or in an informal agreement for all involved billing processes (i.e.: provisioning, availability, reliability, accuracy, security and simplicity). – This is a measure of the efficiency of the MSP for billing purposes.	a) Mean and maximum delay time to receive MS/GOMS billing data upon requested dates at the MSCC. b) Mean and maximum number of billing data received with defects.
NOTE 1 – The acronym "MS/GOMS" is used here to emphasize that the GOMS is strictly related to a specific MS and it is agreed in a specific contract or in an informal agreement between the MSC and the MSP. Therefore, all the performance parameters/indices which are reported herewith may be used either for the GOMS or the MS as needed.		
NOTE 2 – An analogy exists between this parameter/index with the one regarding the communication service to which the MS is applied.		

b) *GOMS performance parameters/indices dependent on the specific type of the MS*

Most of the measurements and related metrics depend on the type of service offered (i.e. digital leased lines, ISDN, ATM networks, digital video distribution, etc.) or depend on the type of MS contract.

For general reference on this subject it is necessary to refer to Recommendation E.800 as the index of the possible quality parameters and to Recommendations Q.822 and X.739 for the common used metrics (and their information models).

Specific service quality parameters are supported by the related standards and Recommendations; see for example, Recommendations G.821 and G.826 for specific parameter on digital transmission systems and Recommendation I.610 regarding ATM networks.

11.2   Measurement methods for the GOMS

Different MS performance measurement methods or techniques are generally available (e.g. intrusive or non-intrusive methods) on a continuous basis or on a specified time schedule. For example, in the environment of the switched telephone services, a detailed description of all current different possibilities is reported in Recommendation M.1230.

It is to be underlined that for each MS a clear indication of the measurement method(s) adopted shall be stated in the relevant contract or in the informal agreement signed by an MSC and an MSP.

11.3   Evaluation methods for the GOMS

Evaluation methods take place to assess the agreed GOMS after measuring relevant performance indices or after obtaining overall measured performance indices. Through evaluation methods, the GOMS state is determined. Evaluation methods may include evaluation policy, algorithm applied for measured performance indices and a limit or threshold to determine the GOMS state. Evaluation methods should be defined in the operational procedures agreed in the contract or in the informal agreement between an MSC and an MSP. An evaluation method itself is outside the scope of this Recommendation.

12   Basic MS processes leading to an Operational Procedures Selection for the management, achievement and improvement of the GOMS (OPSG)

With reference to the general model shown in Figure 1, the management of the agreed GOMS requires at least the following basic MS processes for any involved MSE:

1)   MS information interfacing;

2)   MS data collection;

3)   MS data recording;

4)   MS data filtering;

5)   MS data reporting;

6)   MS data performance monitoring.

A brief description of all the aforesaid basic MS processes is reported in the following subclauses.

In order to ensure appropriate management of these MS processes, at least their accuracy, availability, reliability, security, simplicity, flexibility, promptness and cost shall be taken into account.

12.1 MS information interfacing

Information interfacing consists in providing all types of suitable procedures by an MSP to its MSC(s) to ensure that any type and/or level of interaction as agreed in a contract or in an informal agreement are met. The most important are:

a)   the MSC complaints management interfacing;

b)   the GOMS data reporting management interfacing.

The MSC complaints management interfacing should include all the necessary means and facilities to manage MSC complaints and contacts. This can be done in different ways at the MSCC (e.g. via normal mail, telephone, facsimile, email, at a customer care or help desk).

For GOMS data reporting management interfacing, similar considerations apply, but printable contents formats are necessary in this case and thus normal mail, email, facsimile, Web site or Q interfaces are preferred. Although the implementation of the MS information interfacing process is outside the scope of this Recommendation the following general considerations apply:

–   For an MSC, the network status is invisible. Therefore, accurate information and quick response by the MSP are indispensable to reduce stresses imposed during GOMS unacceptable states.

–   An MSC requires an MSP to increase the access period of time of its customer care staff. For example an MSC requires a customer care staff to handle its requests on a continuous time basis (e.g. over 24 hours).

–   An MSC needs to know the next action which will be undertaken to minimize damages caused by the occurrence of MS outage time due to the presence of GOMS unacceptable states. In this case an MSC is expecting an immediate suggestion from an MSP.

–   An MSC needs to know what is happening in the MS and in the elementary constraints which caused the GOMS unacceptable state. By means of this information an MSC can decide its next action. It is to be highlighted that an MSC requires an MSP GOMS and/or involved MS status and progressive reports in terms of promptness, completeness and reporting period.

The particular way used to exchange information between an MSC and an MSP is also outside the scope of this Recommendation. Examples of the information to be exchanged can be found in Recommendations M.1530, M.1535 and M.1537.

12.2 MS data collection

The main purpose of data collection is to gather all data originated by the interaction between an MSC and an MSP at the MSCC and related to the addressed MS. Moreover, both a contract and an informal agreement imply that the following issues are cleared and accepted by the parties:

a)   What is collected and which are the meaningful indices to build up the GOMS?

b)   How, when, where, how long is data collected for?

The collected data regarding performance indices related to network and service resources will be utilized to build up the most suitable OPSG. This will allow to meet the agreed GOMS. The process will also take care for the collection of the values of all the selected parameters. It is preferable to collect the elementary data in order to keep the ability to aggregate them according to different indices and criteria.

Any collected data will be used as input for the data recording process.

12.3   MS data recording

The collected data shall be recorded through the MS data recording process. The recording process shall follow the agreed criteria and period of time. Examples of recorded information are: names or identifiers codes of MSCs and MSPs, names of contact persons and their contact details (e.g. telephone, facsimile, email), contract number, reasons for the MSC complaints, the recording date and time of all events impacting the MS, GOMS unacceptable state start and stop times, recording period, performance parameters and relevant indices, all measurements of performance indices, performance procedures steps, results outputs, conformance testing and schedule of outputs. The recorded data shall be used by data filtering process[9].

12.4   MS data filtering

Recorded data are converted into performance indices through a MS data filtering process. Data filtering process takes place periodically or on demand basis following the agreement. According to the agreed GOMS, filtered data subject to data reporting are forwarded to a data reporting process.

12.5   MS data reporting

Data Reporting process may be classified into two types:

a)   *Periodic (on a regular basis)*

Periodical reports with information regarding all current performance parameters and indices of the GOMS after conformance testing.

These reports are issued on a regular basis and, in any case, according to the contract or informal agreement stipulated between an MSC and an MSP.

b)   *On exception*

These are unscheduled reports made when an unacceptable state is evaluated or measured for the agreed GOMS.

12.5.1   MS periodic data reporting

According to Recommendation M.1537, the periodic report shall contain three parts[10]:

a)   generic information;

b)   specific information;

c)   reference information.

A detailed description of each of the above-mentioned parts is reported in the following and shall constitute the minimum set.

a)   The generic information part constitutes the header of the report and will include:

    1)   MSC and MSP names;

    2)   MSC address(s);

    3)   MSP address.

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[9] The recorded data are also useful for MSC and MSP internal trend analysis procedures and/or benchmarking.

[10] These are considered the basic, necessary parts but more information may be added according to the needs.

b)　　The specific information for periodic data reporting will include:

    1)　type of service (e.g. data transmission, videoconference);

    2)　MS and MSEs types and names;

    3)　start, termination and any other useful change of date and hours related to each involved MS and relevant MSEs;

    4)　start and end dates and hours to which report parameters refer;

    5)　effective physical location where to measure the performance indices;

    6)　measurement methods used and measurement periods;

    7)　measurement results, service independent and dependent parameters and indices in the considered periods;

    8)　historical measurements and indices aggregated in order to facilitate trend analysis.

c)　　The reference information for periodic data reporting will include:

    1)　agreed threshold levels values and metrics;

    2)　contract references.

12.5.2　MS exception data reporting

Exception reports are "spontaneous", non-scheduled reports that are issued by the MSP when performance exceptions occur (if and how agreed in the contract or in the agreement).

For the reporting format, it is suggested to refer to the model related to the management of fault events and described in Recommendation X.733.

The report structure is formed as follows:

a)　　generic information for exception data reporting;

b)　　specific information for exception data reporting;

c)　　reference information for exception data reporting.

For each of the above three parts, further detailed information is reported in the following:

a)　　generic information for exception data reporting:

    The generic information is the same as that of 12.5.1 reported above.

b)　　specific information for exception data reporting:

    This type of information includes:

    1)　type of service;

    2)　MS (or MSE) types and names;

    3)　start, (cessation) or changes date and time of each involved MS and MSEs;

    4)　date and time to which report parameters refer;

    5)　event type (with the specific description: e.g. "maintenance quality of service");

    6)　event information:

      –　probable cause (with the specific value, for example: "threshold crossed");

      –　specific problem (with the list of indices and measured values);

      –　perceived severity (with the specific description: "warning", "critical", "cleared", etc.).

c)　　Reference information for exception data reporting:

    The reference information is the same as that of 12.5.1 reported above.

12.6 MS data performance monitoring

Besides the basic procedures of an OPSG, as described from 12.1 to 12.5, suitable procedures shall be applied "ad hoc" in case of very severe problems for an MS.

When a sequence of "acceptable" and "unacceptable" states occurs while monitoring a GOMS performance, it is necessary to monitor systematically the state of GOMS in order to carry out the most suitable action.

13 Operational procedures in case of recurrent state of unacceptable GOMS

In order to avoid a critical situation of the GOMS, cooperation between an MSC and an MSP is necessary. This will allow a prompt, satisfactory identification and removal of any problem in the management of the GOMS itself. However, in some circumstances the following events might occur:

–   persistence of some particular long delay causing a major difficulty to the MS despite the activation of usual contacts; any possible investigation is carried out at the MSCC;

–   the same problem and/or difficulty is recurring very frequently in a period of time;

–   a problem is not likely to be removed within a short time thus causing a high probability of a chain of other serious MS malfunctions.

In all the above-mentioned cases and depending on the particular severity of the problems, a suitable procedure can be applied. This is to avoid the problem getting worse.

14 Main advantages of a standardized OPSG

The main advantages of the application of OPSG and its inclusion in a contract or in an informal agreement between an MSC and an MSP. In particular they include:

a)   the MSC systematic understanding, measurements and optimization of the quality level and relevant costs of any MS they are subscribing;

b)   the MSP in optimizing the performance level of the MS and its relative cost;

c)   the definition and update on a permanent basis of a set of standardized procedures regarding the network MSs, including the exchange of any related information as needed;

d)   the possibility for the MSC to make more objective comparisons between the required and measured grade of the MS they are subscribing and consequently to take more impartial technical decisions in the selection between MSPs;

e)   the improvement of cooperation and communication on the telecommunications service environment between MSCs and MSPs.

ANNEX A

MSs brief overview

The following is a brief overview of the main MSs identified in the life cycle of network and service resources elements.

A.1   MS Provisioning[11]

This MS includes a set of MSEs and relevant processes/procedures regarding all technical, commercial, administrative and support activities which are intended to provide and bring into service all network and service resources or any other element as needed, including their subsequent alterations (i.e. any MS change and also its termination) of the MS concerned.

This MS generally starts from the date and time the contract is signed between an MSC and an MSP and it terminates when the involved MSC accepts and agrees to the provided service.

Typical examples of provisioning MSEs are: network and service elements configuration, activation of all network and service related processes/procedures according to specified standards, administration of any involved resource (e.g. of technical, support or supervision type), MS performance management (e.g. performance data collection and statistical reports to analyse performance indices trends).

A.2   MS Monitoring and Performance Management

This MS is constituted by a set of MSEs and relevant processes/procedures dealing with all technical, commercial, administrative and support activities which are intended to ensure the MS retainability and availability of any operational function regarding network and service resources or any other necessary element that is part of the MS concerned.

This MS generally starts after the MS provisioning service is finished and both MSC and MSP agree upon a contract, the main purpose of which is to monitor systematically the status and behaviour of all characteristics and any performance parameter/index related to each network and/or service resource as involved. The performance assessment may be done through two different approaches:

a)   the first is an objective method based on real time and/or off-line automatic quality control procedures and on objective tests (e.g. by using automatic supervisory system, including alarms detection, data collection, data recording/storage, data reporting);

b)   the second is a subjective method based on human observations and relative tests (e.g. by collecting, at a customer care site, at a help desk or any other attended centre, data concerning all MSC complaints, MSC surveys, service outages notified by the MSC).

A.3   MS Restoration

This MS includes a set of MSEs and all relevant processes/procedures dealing with any technical, commercial, administrative and other support activities which are intended to restore any interested MS at the original agreed GOMS at the MSCC, after the occurrence of an MS outage corresponding to an unacceptable GOMS. This type of MS involves the restoration of any type of OAM&P function

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[11] For the scope of this Recommendation, the sales of an MS, that is, the set of processes/procedures applied in the phase of pre-sales, negotiation, preliminary proposals, feasibility support etc., between an MSC and an MSP until the contract will be signed, is not included in the MS Provisioning. In other cases, the sales may be included in MS Provisioning.

regarding each network and/or service resource or any other fundamental MSE as needed, once it has become unavailable.

MS Restoration may be also carried out whenever the MSC and the MSP agree upon an appropriate recovery of a GOMS stable state when it is ascertained that its value is severely or permanently in a degraded state.

MS Restoration may be offered simultaneously with the aforesaid MS Monitoring and Performance Management to ensure actual and continuous availability of the MS together with the permanence of the GOMS in an acceptable state and then to guarantee that the MSC will also have a high availability to use each telecommunications service as required. The MS Restoration may be carried out either automatically or manually through human resources. In both cases appropriate procedures or special recovery mechanisms, which sometimes can be quite sophisticated, permit to localize and clear any MS outage and GOMS unacceptable state, within a specified or agreed TRMS. It is also very important that the occurrence of each MS outage and GOMS in an unacceptable state is maintained within a specified or agreed limit/target. This will avoid MSC complaints, dissatisfaction and, in particular circumstances, even a break of the MS contract.

A.4   MS Billing Integrity

This MS is constituted by a set of MSEs and relevant processes/procedures regarding all technical, commercial, administrative and support activities which are finalized to the provision of the bill to the MSC from the date and hours the MS Provisioning has ended the hand-over and acceptance activities. An MS bill can be provided generally on the basis of the recorded MS time utilization (e.g. seconds, minutes, hours or days), on a per number or type of the related telecommunications service or according to specific MSC requirements.

The bill provided to MSCs shall be very consistent with the effective utilization of the service. To achieve this goal there are different methods mainly based on punctual checks in order to verify systematically the correctness, the completeness and the consistency of all recorded billing data. MSC complaints on this particular field should be avoided as much as possible.

The main performance billing parameters are:

a)   billing availability (e.g. the MSC can access the billing information at the MSCC);

b)   billing security (e.g. confidentiality of an MSC billing information from third parties, or prevention from procedural human or machine errors);

c)   billing simplicity, that is ease of billing information to the MSC;

d)   billing flexibility (e.g. according to specific dates/hours chosen by the MSC).

A.5   MS Security

This MS is constituted by a set of MSEs and relevant processes/procedures regarding all technical, commercial, administrative and support activities which are finalized to introduce and maintain into the MS management system, suitable countermeasures for the correct use of the resources.

MS Security management is concerned with three main aspects (see also the reference NMF503 in Appendix IV):

a)   protection of the MSCC against undesired intrusions/unauthorized access (e.g. against unknown MSCs and/or MSPs attempting to gain access to the MSCC) which can cause damages and malfunctioning in the MS;

b)   data security against privacy violations, by assuring integrity, validation and confidentiality of exchanged information between an MSC and an MSP;

c)   denial-of-service attacks (deliberate overloading or shutting down of network services).

Security mechanisms are based on algorithms which recognize the incoming data and make use of a suitable key (e.g. encrypted) in order to process the input/output data (e.g. the software resource security checks access to MS software resources). The adopted mechanisms for key management can be based on standard specifications and therefore they are usually not secret. The grade of security depends on the grade of secret and inviolability of the key, which must be different for each MSC and can be valid for a single or for multiple sessions. The management of these keys, which is normally assigned to a system administrator for the security of MS resources (e.g. software) who specifies all activities allowed for these resources (e.g. read, write and execute operations) and is able to grant permission for the same activities, consists in:

•   defining the key creation criteria;

•   assigning keys to authorized entities (e.g. use of specific identifiers and passwords);

•   storing the digits for the key;

•   destroying the unused keys.

The above functions must be performed in a multi-user and multi-terminal architecture.

The security of an MS represents currently a field of a large growth of commitments regarding studies and research to ensure an adequate set-up of any telecommunications network and service resources which, more and more, should be suitable to meet the MSC evolving expectations on privacy domain. It has to be emphasized that the MSC should also establish a minimum set of security mechanism to protect MS information from being accessed by unauthorized persons in its own operating environment.

A.6   MS Auditing

This MS includes a suitable set of MSEs and relevant processes/procedures regarding technical, administrative, accounting issues, which are established in order to provide a planned, independent and documented assessment to determine whether agreed-upon requirements are being met. The quality audit process can be carried out by three different methods, which can independently run:

a)   first-party audit, done internally by the MSP on its own organization;

b)   second-party audit, which consists of an extrinsic audit done by the MSC on the MSP organization: for example, an MSC may ask for a check of the audit processes regarding the billing;

c)   third-party audit, which is usually indicated as registration audit (e.g. ISO 9000 certification audit), done by a third entity, different from both the MSC and the MSP.

An MS Auditing is mainly related to type c).

ANNEX B

Maintenance Service Availability calculation formula and definition of Maintenance Service Degradation Factor

The concepts and calculation formulae described in this annex shall be used for the assessment of the performance indices of each process included in MSEs which constitute an MS. Each of these performance indices shall be monitored systematically in order to ensure a proper level of performance of each MSE. For further information, refer to Appendix IV (Bibliography).

B.1   Basic Maintenance Service Availability calculation formula

The Maintenance Service AVailability (MSAV) can be expressed as a percentage (MSAV%) to indicate the time during which a specified MSE is operational at the MSCC. The word "operational" means that an MSC is able to use the required MS with the specified GOMS as agreed in a contract or in an informal agreement stipulated with an MSP.

If there is an event which at the MSCC is defined as a service outage for the MS concerned, the outage time duration is considered as an interval of unavailability for the involved MS and all its MSEs.

In a determined interval of agreed activity/functioning of the agreed or contracted MS, one or more outage(s) may occur. The total outage(s) time represent the total unavailability time (UNAV) which can be expressed in percentage and its complement to 100% represent the MSAV%, i.e.:

$$MSAV\% = 100\% - UNAV\%$$

where UNAV% is defined as follows:

$$UNAV\% = \frac{\sum outage\ interval}{Active\ time} \times 100\%$$

The concepts of availability and unavailability correspond, for the MS concerned, respectively to specific states of acceptable or unacceptable GOMS states (see also clause 7).

B.2   Maintenance Service Elements degradation state – Definition of maintenance Service Degradation Factor (SDF)

If, in a determined interval of agreed activity/functioning of the agreed MS, it occurs that one or more of its constituting MSEs has a partial outage, for the calculation of the unavailability, it is necessary to consider a Service Degradation Factor (SDF) which varies from 0 to 1:

$$0 \leq SDF \leq 1$$

If $SDF = 0$, there is a situation of partly MS outage. This corresponds to an acceptable state of degraded MS.

If $SDF = 1$, there is the complete MS outage and this corresponds to an unavailable MS state or to a completely unacceptable MS.

In this case the preceding formula can be modified as follows:

$$UNAV\% = \frac{\sum (outage\ interval \times SDF)}{Active\ time} \times 100\%$$

With reference to a specific MS and its relative contract or informal agreement it is possible to produce a specific list of SDF values in correspondence with each type of event which may occur.

APPENDIX I

Example of the application of an OPSG to an MS for Videoconferencing

This example describes a network service with particular emphasis on its MS aspects.

I.1 Overview

This service provides multi-point videoconferencing capability to ISDN customers having an Recommendation H.320[12]-compliant videoconferencing system. It is provided on reservation basis and consists of the following elements after the agreement of a GOMS between an MSP and an MSC needing videoconferencing:

– site information registration;

– site conformance testing;

– conference reservation;

– videoconferencing;

– billing.

I.2 MSEs and operational procedures

1) *Site information registration*

Using this MSE, the MSP establishes MSC information within so-called customer information base.

The MSC provides site information for the MSP, which includes:

– type of conferencing system;

– ISDN number;

– location information associated with contact point information.

The following operational procedures constitute this MSE:

– registration data collection from an MSC;

– data consistency checking of overall registered MSC information;

– registered information access by an MSC;

– registration confirmation data reporting.

2) *Site conformance testing*

Using this MSE, the registered site receives a certificate allowing the system to participate in a videoconference. This MSE consists of test scheduling and testing processes. The test scheduling process determines date and time when the testing shall be carried out and consists of the following operational procedures:

– testing date candidate listing;

– testing date negotiation;

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[12] ITU-T Recommendation H.320 (1996) – Narrow-band visual telephone systems and terminal equipment.

–   testing date and procedure reporting.

The testing process tests the registered site with the following operational procedures:

–   dialling-out test;

–   dialling-in test;

–   additional functional test;

–   test result registration;

–   test result reporting;

–   MSC accesses to the test result.

3)   *Conference reservation*

Using this MSE, a requested videoconference is designed and scheduled. This MSE consists of reservation request receiving, videoconference design and scheduling and reservation confirmation reporting processes. The reservation request receiving process has the following procedures:

–   reservation data collection;

–   reservation data verification;

–   reservation data receive notification;

–   MSC accesses to the reservation data.

The videoconference design and scheduling process is achieved by the following operational procedures:

–   port availability verification;

–   port selection;

–   scheduled data collection.

The reservation confirmation reporting process consists of the following procedures:

–   reservation data reporting;

–   reported data confirmation;

–   MSC accesses to the reservation data.

4)   *Videoconferencing*

Using this MSE, videoconferencing services are carried out. These are constituted by videoconference set-up, start-up, conference operation and restoration processes.

The videoconference set-up process has the following operational procedures:

–   conference set-up data retrieval from reservation data;

–   bridge schedule data setting.

The videoconference start-up process has the following operational procedures:

–   conference start;

–   dialling-out;

–   bridge port verification;

–   MSC accesses to the verification data.

The conference operation process has the following operational procedures:

–   director control;

–   system monitoring;

–　　conference configuration modification;

–　　conference status data reporting.

The videoconference restoration process has the following operational procedures:

–　　alarm data collection;

–　　problem data collection;

–　　protection switching;

–　　conference restarting.

5)　　*Billing*

Using this MSE, a billing information is established and billing data is reported to an MSC. The following operational procedures constitute this service element:

–　　billing data retrieval;

–　　billing data reporting;

–　　billing condition setting;

–　　billing data correction.

I.3　　Performance parameters and indices

Performance indices subject to an agreement in GOMS are identified in each MSE.

1)　　*Site information registration*

–　　Time to receive confirmation: This parameter indicates time consumption between receiving site information registration request and receiving registration completion report by a customer. The mean value of this parameter represent a relevant index and it is expressed as an average time value. Time units are "day" or "hour".

–　　Invalid request count: This parameter identifies number of request that was not completed because of defects in the requesting information.

–　　Maximum site number: This parameter provides maximum site number that an MSC is allowed to register.

2)　　*Site conformance testing*

–　　Time to test a site: This parameter indicates the site conformance testing time. It starts at the scheduled time and ends at the test completion time. The relevant index is the mean time to test and is expressed as an average value of time.

–　　Conformable site ratio: This parameter indicates a ratio of conformed sites to tested sites.

–　　Test achievement ratio: This parameter indicates a ratio of tested sites to requested sites.

3)　　*Conference reservation*

–　　Time to receive confirmation: This parameter indicates the time consumed between sending reservation request and receiving reservation confirmation. The relevant index is the mean time to receive confirmation and it is expressed as an average value of time.

–　　Reservation completion ratio: This parameter indicates a ratio of completed reservations to attempted reservations.

–　　Reservation change ratio: This parameter indicates a ratio of reservation change attempts to completed reservations.

–   Cancelled reservation ratio: This parameter indicates a ratio of cancelled reservations to completed reservations.

4)   *Videoconferencing*

–   Start delay time: This parameter indicates the delay time of conference from a scheduled conference start time. The relevant index is the mean start delay time and it is expressed as an average value of time.

–   Troubled conference number: This parameter indicates the number of conference in which a service outage was identified.

–   Restored conference number: This parameter indicates the number of conference on which restoration took place because of some service outages.

–   Time to restore a conference outage: This parameter indicates the time of restoration between service outage detection and restoration confirmation. The relevant index is the mean time to restore a conference outage and it is expressed as an average value of time.

–   Mean outage site number in a conference: This parameter indicates the average site number in a conference that underwent some outages.

–   Status report number: This parameter indicates the status report number sent by an MSP.

5)   *Billing*

–   Response time to receive billing data upon request: This parameter indicates the average time needed to get response from the MSP of billing data. The relevant index is a mean time to receive billing data upon request and it is expressed as an average value of time.

–   Billing data defect number: This parameter indicates billing data number in which some defects were identified.

APPENDIX II

**Example of the application of an OPSG to
an MS for Internet service**

II.1   Overview

Internet service provides communication capabilities and information handling function relevant to email, News, Web, etc. Typical MSs for Internet, after the agreement of a GOMS between an MSC and an MSP, are the following:

–   MS activities reporting;

–   MSC contact for service outage support;

–   network and service performance monitoring and reporting;

–   MS Security;

–   MS Billing.

II.2   MSEs and operational procedures

1)   *Maintenance activities reporting*

Using this MSE, the MSP reports the MS information such as:

–   detected service outage;

–   service outage clearance progress.

News and/or Web is often utilized for this service.

This MSE is constituted by the following main operational procedures:

– alarm monitoring;

– network performance monitoring;

– host computer performance monitoring;

– MSC complaints evaluation;

– service outage clearance planning.

2) *MSC for service outage support*

Using this MSE, the MSP receives the MSC complaints on service outages related to the MS of Internet service by means of different facilities, such as telephone, facsimile, etc.

The MSC provide site information to the MSP, which includes:

– MSC premises equipment profile (e.g. personal computers, modem);

– MSC premises software profile (e.g. application package);

– access method to Internet service (e.g. via telephone dial-up, ISDN telephone dial-up, leased line);

– access location (e.g. via telephone number of dial-up);

– service outage profile (e.g. connection failure, login failure, application failure).

This MSE is constituted by the following main operational procedures:

– MSC complaints received by means of several facilities, such as telephone, facsimile or email;

– MSC complaints data recording;

– data retrieval of MSC profile.

3) *Performance monitoring/reporting regarding network and service resources*

Using this MSE, the MSP monitors the communication capabilities and provides the following main performance reports to the MSCs:

– dial-up accessibility log;

– data transmission throughput log.

This MSE consists of the following operational procedures:

– monitoring the network equipment performance (e.g. dial-up router, usage ratio);

– measuring the data transmission performance;

– data collection of monitored and measured data;

– collected data recording;

– retrieval of the recorded data and statistical evaluation;

– reporting the statistical evaluation result.

4) *Security*

Using this MSE, the MSP secures the MSC communications. This MSE supports the following procedure:

– password change.

5) *Billing*

Using this MSE, a billing information is established and a billing data is reported to an MSC. This MSE is constituted by the following operational procedures:

– billing data retrieval;

– billing data reporting;

– billing condition setting;

– billing data correction.

II.3 Performance parameters and indices

Performance indices subject to an agreement in GOMS are identified in each MSE. The most important are:

1) *Maintenance activities reporting*

– Mean time to initial report of outage service detection. This parameter indicates average time consumption between outage service detection and its reporting.

– Complaints handling time: "Activity time of the MSCC".

– Accessibility to contact with customer contact care staff (e.g. by telephone, facsimile). This parameter indicates a ratio of successful call (e.g. by telephone, facsimile).

– Mean time to respond: This parameter indicates the average time consumption since an MSC complaint is received and the first MSP response for this complaint.

– Mean time to MSC service outage resolution: This parameter indicates average time consumption for resolving MSC complaints.

2) *Performance monitoring/reporting regarding network and service resources*

– Lead-time for reporting the monitored data: This parameter indicates the delay between measurement and reporting for performance data. For example, the delay of dial-up accessibility report containing the log from 8 days ago up until 24 hours ago is 24 hours.

3) *Security*

– Ready for service of changing the password: if on-line password change is supported. The changed password is expected to be valid within seconds.

4) *Billing*

– Mean response time to receive billing data upon request. This parameter indicates the average time required to receive billing data response from MSP.

– Ready for service to change a billing menu. This parameter indicates the period of time required to change a billing menu.

APPENDIX III

**Example of the application of an OPSG to an MS Provisioning for
Leased Circuit Services (LCS)**

III.1 Overview

This MS consists of all activities which are related to the provisioning of end-to-end communication capabilities via Leased Circuit Services (LCS) between two parties located in different countries; it may involve one or more MSP at both sides of the national and/or the international parts of the overall required interconnection. It normally implies the set-up of different network and service OAM&P supporting resources. These are strictly dependent on the required network capacity and adequate procedures which are specifically applicable to the LCS. Any MS provisioning requirement and other particular characteristic, including specific performance parameters/indices related to the GOMS, shall be clearly specified and agreed between the MSC and the MSP in a suitable contract. The MS provisioning for LCS service generally starts from the time the contract is signed and terminates after the hand-over (i.e. the delivery) of the MS/GOMS from an MSP when the MSC accepts this MS/GOMS. All procedures involved in the relative OPSG for the achievement/improvement of an agreed GOMS, need to be carried out in order to mainly achieve the Ready for MS/GOMS provisioning date (RFMS) which, in practice, corresponds to the agreed deadline for the availability of the MS/GOMS involved. It is to be noted that this RFMS date is strictly related to the agreed Ready For Service (RFS) date of the LCS and that, in some cases these dates may be the same.

III.2 MSEs and operational procedures

The basic MSEs, each of which involves specific processes and relevant procedures with specified performance parameters/indices contributing to define the overall GOMS, are the following:

1) *MSE design for LCS*

   This MSE constitutes the phase of designing all necessary logical and physical network and service resources. It includes a careful evaluation of the availability of all necessary equipment, software and of any other type of support procedure related to the particular MSC requirements. It starts from the time the MS/GOMS contract is signed and terminates when all the involved MS network and service resources are ready for negotiation activities to start.

2) *MSE negotiation for LCS*

   This MSE is a proper set of agreements processes among all MSPs involved in the MS/GOMS provisioning for the LCS. In order to reach all necessary agreements, the exchange of particular formats containing all types of MS information and useful data is necessary to ensure the start of the next phase of configuration. The MS/GOMS negotiation starts at the time the design is completed and it ends at the time the MS/GOMS configuration of all needed network and service resources can initiate. Sometimes, when several MSPs are concerned, this MSE may be quite complex especially for the various procedures involved. Such cases need to be carefully managed in order to prevent rapid augmentation in the growth in the delay time for the starting of the configuration. It is to be noted that the feedback from MS/GOMS configuration goes into the MS/GOMS design for the purposes of correction or improvement.

3)   *MSE configuration for LCS*

This MSE consists in collecting, properly assembling and recording all data regarding any network and service resources as needed to start the MS/GOMS ordering phase towards all entities (internal or external to an MSP). It starts from the MS/GOMS negotiation completion and it terminates when all network and service resources which are necessary for the LCS are put together and their utilization/occupation needs to be recorded in an adequate way (e.g. using appropriate network and service support systems). This MSE generally includes different exchanges of information and the confirmation of all resources and relevant procedures and any standard to be applied later when the MS/GOMS ordering phase starts.

4)   *MSE ordering for LCS*

This MSE starts from the MS/GOMS configuration completion and it consists in preparing, forwarding and receiving receipt notification from all entities concerned in a specific LCS of specific work orders. These contain all data and information which later shall allow to proceed with any practical MS/GOMS testing for the implementation of the network and service resources associated with the particular LCS. These MS/GOMS orders concern all technical, administrative and billing purposes (i.e. activation testing, billing, accessibility of the MSC at the MSCC, etc.).

5)   *MSE testing for LCS*

This MSE is an appropriate set of MS/GOMS tests and measures regarding all the characteristics of network and service resources which are involved in the LCS. This testing is performed in order to ensure that the standard used for all resources conform to the MSC requirements as well as to the agreed MS/GOMS provisioning. The MS/GOMS testing phase ends with an MSP hand-over (also called delivery) for the interested LCS to the MSC and its subsequent MS/GOMS acceptance. All data pertaining to testing shall be properly recorded and exchanged among all involved end-to-end entities by means of a specified MS/GOMS reporting to be made with a periodicity as agreed between an MSC and an MSP.

6)   *MSE hand-over and acceptance for LCS*

Using this MSE which represents the last one in the OPSG for the MS/GOMS provisioning, the MSP hands over the MS/GOMS to an MSC and finally the MSC accepts it by furnishing its agreement and signature.

In Figure III.1 are illustrated all the basic MSEs of an OPSG and their relationships for the MS/GOMS Provisioning for LCS.

It is to be noted that after an MSC provides its acceptance of the MS/GOMS provisioning for an LCS, it is possible to start the billing process for this MS and consequently also that of the related LCS. The description of the MS Billing and relevant GOMS aspects are outside the scope of this OPSG example.
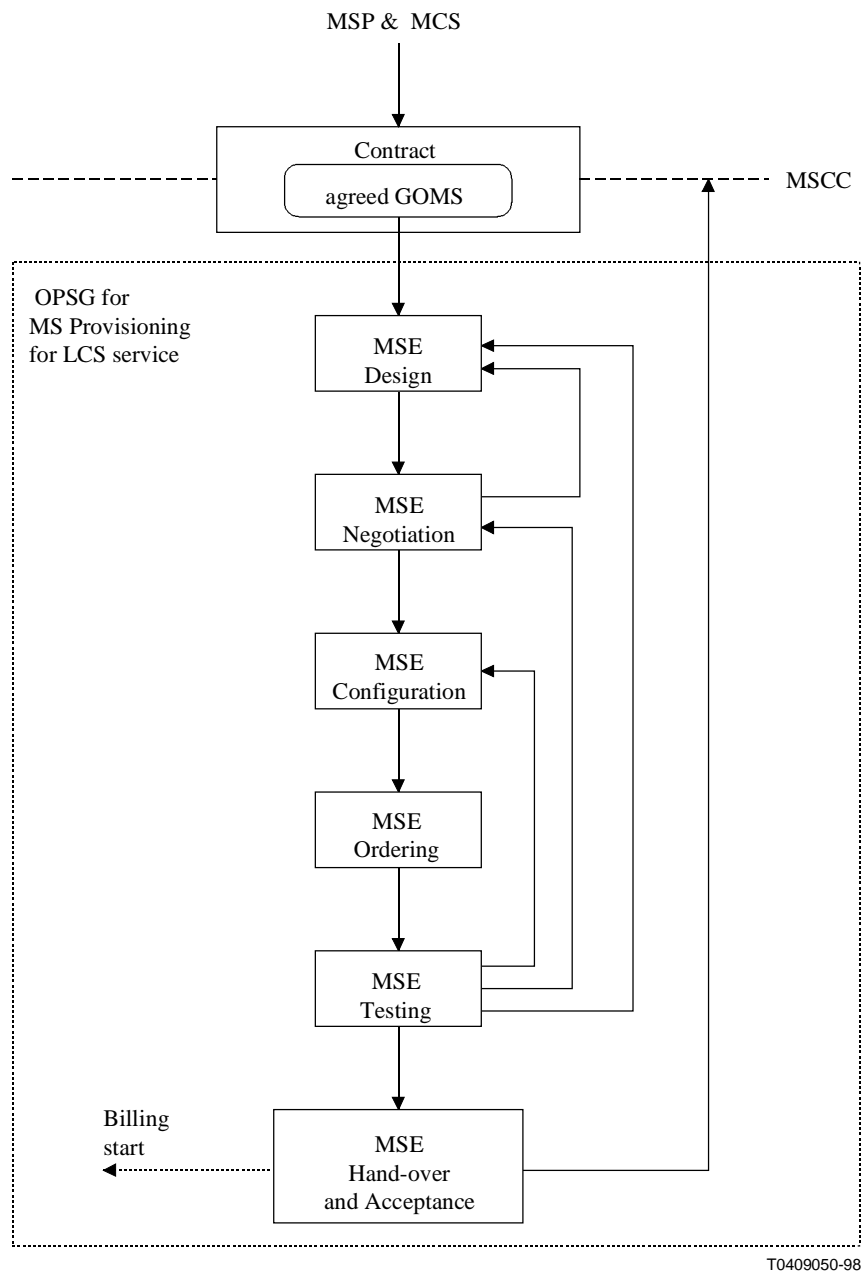
**Figure III.1/M.1539 – Basic MSEs and their relationships for the
MS/GOMS Provisioning for LCS**

III.3 Performance parameters and indices

For all the MSEs described above, the main parameters/indices for the MS/GOMS provisioning of
LCS are shown in the following Table III.1.

Table III.1/M.1539 –Main performance parameters/indices for the MS/GOMS provisioning for LCS (see also Notes 1 and 2)

	Performance parameter	Performance indices
1)	Time for MS/GOMS Provisioning at the MSCC Start: MS/GOMS contract signed. End: MS/GOMS MSC acceptance.	Meantime to provide MS/GOMS.
2)	Successful MS/GOMS Provisioning rate at the MSCC – Probability that MS/GOMS Provisioning is successfully completed by the date agreed in the contract (i.e. the RFMS date) and at that date the GOMS is acceptable	Mean and absolute number of times the MS/GOMS Provisioning is established by the agreed dead line (i.e. the RFMS date) with respect to the total number of MS provisioning requests.
3)	Time to design MS/GOMS requirements at the MSCC Start: MS/GOMS contract signed. End: MS/GOMS ready to negotiate.	Mean and maximum time to design.
4)	Time to negotiate MS/GOMS requirements at the MSCC Start: MS/GOMS design ended. End: MS/GOMS ready to configure.	Mean and maximum time to negotiate.
5)	Time to configure MS/GOMS requirements at the MSCC Start: MS/GOMS negotiation ended. End: MS/GOMS ready to order.	Mean and maximum time to configure.
6)	Time to order MS/GOMS requirements at the MSCC. (This parameter is also called time to commit) Start: MS/GOMS configuration ended. End: MS/GOMS ready to test.	Mean and maximum time to order.
7)	Time to Test MS/GOMS requirements at the MSCC Start: MS/GOMS ordering ended. End: MS/GOMS ready to hand-over.	Mean and maximum time to test.
8)	Time to hand-over and acceptance of MS/GOMS requirements at the MSCC Start: MS/GOMS test ended. End: MS/GOMS MSC acceptance.	Mean and maximum time to hand-over and acceptance.

NOTE 1 – The acronym "MS/GOMS" is used here to emphasize that the GOMS is strictly related to a specific MS and it is agreed in a specific contract or in an informal agreement between the MSC and the MSP. Therefore, all the performance parameters/indices which are reported herewith may be used either for the GOMS or the MS as needed.

NOTE 2 – An analogy exists between this parameter/index with the one which is used for the LCS to which the MS provisioning is applied . For example, considering the performance parameter at point 2) above, the correspondent performance index for the LCS are the "mean and absolute number of times the LCS is established within the agreed RFS date".

APPENDIX IV

Bibliography

The following are additional reference documents of other entities or standardization organizations:

–   Network Management Forum (NMF) – NMF 701, *Performance Reporting Definitions Document*, Issue 1.0, April 1997.

–   Network Management Forum (NMF) – NMF 503, *Performance Reporting Business Agreement*, Issue 1.0, March 1997.

NOTE – Since these documents were published, NMF has changed its name to TeleManagement Forum.

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