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

Designations and information exchange

Network maintenance service performance agreement (MSPA)

ITU-T Recommendation M.1532

(Formerly CCITT Recommendation)

ITU-T M-SERIES RECOMMENDATIONS

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

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ITU-T Recommendation M.1532

Network maintenance service performance agreement (MSPA)

Summary

This ITU-T Recommendation, making reference to the basic principles of the management of the Grade Of network Maintenance Services (GOMS) at the Maintenance Service Customer Contact point (MSCC)[1], provides to both a Maintenance Service Customer (MSC) and a Maintenance Service Provider (MSP) of any Maintenance Service (MS), specific guidelines to establish and manage the effectiveness of an appropriate network[2] Maintenance Service Performance Agreement (MSPA).

An MSPA is a set of appropriate procedures and targets related to specific performance parameters, action plans and relevant action points which are formally or informally agreed between an MSC and an MSP, in order to support ITU-T Recommendations and achieve and maintain the agreed GOMS under all possible operational circumstances. If both MSC and MSP wish to further improve the previously agreed GOMS, the MSPA guidelines may also be used. The MSPA may be an integral part of a contract or an informal agreement between the parties involved.

Source

ITU-T Recommendation M.1532 was prepared by ITU-T Study Group 4 (1997-2000) and approved under the WTSC Resolution 1 procedure on 4 February 2000.

Keywords

Action point, actions plan, grade[3] of maintenance service, maintenance service[4], maintenance service contract[5], maintenance service customer contact point[6], maintenance service customer[4], maintenance service element(s)[4], maintenance service informal agreement[5], maintenance service performance agreement[7], maintenance service performance agreement management, maintenance service performance agreement management difficulty index, maintenance service provider[4], maintenance service unavailability[4], management of the grade of maintenance service[8], quality of service[9].

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1 The GOMS concepts and its management are described in ITU-T Recommendation M.1539.

2 The word network is used here to emphasize that the MSs are related to the entire telecommunication network and it will be avoided further within the text.

3 For the purpose of this ITU-T Recommendation the terms: grade of service, service level, service performance are similar.

4 The definition is reported in ITU-T Recommendation M.1539.

5 The definition is reported in ITU-T Recommendation M.1537.

6 For a generic service the term "Service Access Point (SAP)" is often used.

7 Similar terms such as: "Service Level Agreement (SLA)", "Service Level Guarantee (SLG)" and "Service Quality Agreement (SQA)" are currently used in the area of telecommunications services. ITU-T Recommendation E.801, in particular, shows the main SQA concepts and the framework to be used by Network Operators/Providers and/or Service Providers for any switched or dedicated telecommunication service.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. 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 turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

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

NOTE

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

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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[8] The main concepts are reported in ITU-T Recommendation M.1539.

[9] In the area of concepts relating to "quality of service" and "network performance" a simple and consistent set of terms and definitions is reported in ITU-T Recommendation E.800.

CONTENTS

Introduction

In today's telecommunications environment, the provisioning of all features of any MS requires more and more an appropriate inter-operability between all the various maintenance organizations within different Network Operators/Service Providers and Customers which are involved in the MS domain concerned. In this multiple service providers situation, according to ITU-T Recommendation M.1539, in order to achieve the overall GOMS objective as agreed for any specific MS between an MSC and an MSP in a contract or in an informal agreement, it is necessary to properly manage the overall GOMS. Considering both MSC and MSP point of view, an efficient GOMS management is very important as it is strictly related to their individual business. At present, in particular, each MSP focuses to assure the "honouring at the operational level" of all contracts or informal agreements regarding any offered MS which are stipulated with every MSC. Nevertheless, in some cases, the GOMS agreed objective is very hard to attain or difficult to maintain. This is generally due to frequent instability, or sometimes to sudden drops of the performance values with respect to the specified limits/targets of one or more of the performance parameters/indices contributing to the overall GOMS. These parameters/indices are related to all procedures of each process pertaining to a particular Maintenance Service Element (MSE) within the adopted Operational Procedures Selection for the management, achievement and improvement of the agreed GOMS (OPSG). If these events of performance degradation or dropping are not analysed immediately, and their causes removed in a reasonable time, this will lead to a permanent condition of "unacceptable MS/GOMS".

In this case, in order to achieve the overall agreed GOMS, it is necessary to review carefully all initial performance parameters regarding each procedure of involved processes and relevant performance indices, and also whether their assessments/measurements are still valid or whether they need to be revised, or completely changed with new ones.

In the above context, the most suitable current way to manage all QoS aspects of any MS is to use an MSPA between an MSC and an MSP of the involved MS. The MSPA may be an integral part of the contract or the informal agreement between the parties concerned. An MSPA normally implies an appropriate set of procedures and targets, formally or informally agreed and signed between an MSC and an MSP in a specified actions plan, and relevant action points. Every actions plan has individual objectives and specified modalities to be carried out with a precise deadline for its completion or, when necessary, its revision or update.

Another important issue to consider is the ever-increasing demand for an efficient MSPA management, either considering a simple situation of one MSPA or when, due to a great number of simultaneous MSPAs, to satisfy the pressure of MSPA requests, several MSPAs co-exist. To ensure an efficient management of any number of required MSPAs, it is necessary to find out suitable criteria such as the continuous evaluation of an appropriate index representing the difficulty level driven by all technical and commercial business aspects related to the MS/GOMS concerned. An efficient MSPA management may imply an increase of the operational cost above the values which were related to the previous contract or informal agreement as stipulated between the MSC and the MSP.

It is to be noted that all concepts, methodologies, objectives and any possible target as described in an MSPA, may also be applied when more than one MSP is involved in the interested MS. That is, in particular, the case of the MS/GOMS agreed between an MSP and another MSP where, in practice, one acts as an MSC and the other as an MSP. Similar considerations apply when an MSPA is signed between Network Operators and/or between Network Operators and Service Providers. In both cases, one of the Network Operators or Service Providers plays the role of the MSP and the other the role of the MSC.

ITU-T Recommendation M.1532

Network maintenance service performance agreement (MSPA)

1 Scope

An MSPA provides guidelines to any MSC and MSP of the interested MS, in order to agree upon and carry out an appropriate actions plan, to ensure the effective achievement or, under specific requests, even the improvement of the GOMS.

This ITU-T Recommendation specifies:

a) the MSPA general aspects to achieve the agreed GOMS based on QoS general requirements from both MSC and MSP;

b) the MSPA structure associated with basic process functions that characterize the nature of MSPA and the MSPA reference model;

c) MSPA management criteria and relevant objectives.

This ITU-T Recommendation does not specify:

a) any value for overall GOMS or its relevant performance parameters/indices being agreed in an MSPA, or in an MSPA/contract or in an informal agreement between an MSC and an MSP;

b) any particular action involved in an MSPA to establish and manage all types of OAM&P functions, processes and relevant procedures which in practice imply the specific implementation of an OPSG between an MSP and an MSC for the achievement of a particular GOMS;

c) performance parameters/indices and relevant values 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 and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

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

[2] ITU-T Recommendation M.1230 (1996), *Method to improve the management of operations and maintenance processes in the International Telephone Network*.

[3] ITU-T Recommendation M.1530 (1999), *Network maintenance information*.

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

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

[6] ITU-T Recommendation M.1539 (1999), *Management of the grade of network maintenance services at the maintenance service customer contact point (MSCC)*.

[7] ITU-T Recommendation E.440 (1996), *Customer Satisfaction Point*.

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

[9] ITU-T Recommendation E.801 (1996), *Framework for service quality agreement*.

3 Abbreviations and acronyms

This ITU-T Recommendation uses the following abbreviations and acronyms:

ACPL	ACtions PLan
AP	Action Point
BC	Basic Characteristics of MSPA
FRP	Fault Report Point
GOMS	Grade Of Maintenance Service
LCS	Leased Circuit Service
MICC	Maintenance Information to be exchanged at the Customer Contact point[10]
MMDI	MSPA Management Difficulty Index
MS/GOMS	The GOMS related to a specific MS
MS	Maintenance Service
MSC	Maintenance Service Customer
MSCC	Maintenance Service Customer Contact point
MSE	Maintenance Service Element
MSP	Maintenance Service Provider
MSPA	Maintenance Service Performance Agreement
OAM&P	Operations, Administration, Maintenance and Provisioning
OPSG	Operational Procedures Selection for the management, achievement and improvement of the GOMS[11]
QoS	Quality of Service
RFMS	Ready For Maintenance Service/GOMS date
RFS	Ready For Service date[12]
SC	Specific Characteristics of MSPA
μTPMS	Mean Time to Provide a Maintenance Service/Grade Of Maintenance Service[13]
μTRMS	Mean Time to Restore a Maintenance Service/Grade Of Maintenance Service[14]

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[10] The basic MICC concepts and related definitions are reported in ITU-T Recommendations M.1535 and M.1537.

[11] The OPSG concepts and relevant definition are reported in ITU-T Recommendation M.1539.

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

[13] The concepts and definitions of Time to Provide an MS/GOMS (TPMS) and relevant indices, are reported in ITU-T Recommendation M.1539.

[14] The concepts and definitions of Time to Restore MS/GOMS (TRMS) and relevant indices, are reported in ITU-T Recommendation M.1539.

4 Terms and definitions

Terminology and definitions relating to this ITU-T Recommendation are provided in ITU-T Recommendations M.60, M.1230, M.1535, M.1537, M.1539, E.800 and E.801. This ITU-T Recommendation defines the following terms:

4.1 maintenance service performance agreement (MSPA): For a specific MS, an MSPA is a particular agreement between an MSP and an MSC in order to support ITU-T Recommendations and to effectively achieve, maintain and/or also to improve, whenever it is required, the agreed GOMS as specified in the contract or in the informal agreement relating to this MS. An MSPA is a set of appropriate procedures and targets which are related to specific performance parameters/indices, action plans and relevant action points. The MSPA may be an integral part of the original contract or the informal agreement.

4.2 action point: An "Action Point (AP)" is a set of appropriate sub-actions or functions, including all specifications and any necessary information belonging to a specified "actions plan", which is agreed between an MSC and an MSP in order to avoid, remove any situation of recurrent negative trend or hard to be reached for the agreed GOMS or to ensure its improvement whenever it is required. The type and/or particular characteristic of each selected AP depends on the specific conditions or events which may occur and cause to establish that the assessed/measured GOMS is not conforming to the value of the agreed GOMS objective.

4.3 actions plan: An "ACtions PLan" (ACPL) is a set of appropriate "Action Points (APs)" agreed for the MS/GOMS achievement or improvement purposes. It constitutes the carrying structure of an MSPA. Every ACPL has individual objectives, specified modalities to be carried out and precise dead-line when it must be considered completed or it is necessary to review it and/or to make its update.

4.4 MSPA management difficulty index (MMDI): The MMDI is an index which represents a current difficulty level to manage efficiently at the MSCC one MSPA or several MSPAs which may co-exist simultaneously. When the MMDI is low, the MSPA is managed efficiently and when it is high the MSPA is managed inefficiently.

5 MSPA objectives and benefits

For any MS, the main objectives of an MSPA are:

1) to allow the conformance achievement of the agreed GOMS. This permits, in particular, to the MSP to effectively "honour the contract at the operational level";
2) to stabilize and regularly review the validity or real effectiveness of the OPSG used for the achievement of the agreed GOMS. This means that both the MSC and the MSP will be able to carry out a systematic update of any network and service resource, that is the implementation of any modification or additional procedure within the OPSG previously adopted;
3) to obtain, on the basis of the optimization as indicated in the aforesaid item 2), a significant cost-saving for both the MSC and the MSP;
4) to improve further the understanding and cooperation between an MSC and an MSP for any technical and commercial aspects of the MS concerned and particularly for the issues regarding the GOMS and its goals.

The introduction of an MSPA provides to both an MSC and an MSP the following main benefits:

1) the continuous optimization of the use of all their own resources employed in the involved MS;
2) the identification of an ever increasing positive influence for their MSs costs and specific business applications.

6 MSPA for GOMS management

For a specific MS/GOMS, an MSPA normally involves the establishment, carrying out, follow-up and administering of an appropriate ACPL. This ACPL must be applied in order to solve GOMS specific degradation or sudden drops which might imply that its agreed value/target may not be achieved. Whatever will be the choice of this ACPL, in all cases, it will help to solve misunderstanding or subsequent GOMS assessment/measurement problems both to MSC and MSP.

It must be emphasized that even though the MSPA is mainly GOMS oriented, it has normally strict linkages to commercial conditions and also to business aspects of the MS contract for both MSC and MSP.

Therefore, any information regarding the GOMS management and particularly the results of its continuous assessment and any stability problem must be collected, recorded, and reported[15]. Any type of impairment cause and its localization shall also be identified and stored for any future MSPA reference or statistical purpose.

When it is ascertained a persistent GOMS instability or sudden drops of the performance values lasting for a significant time and this situation may impact the achievement of the agreed MS/GOMS. For the involved MS, both MSC and MSP should act as follows:

1) If the MSPA already exists (i.e. it is already an integral part of the contract or the informal agreement), both MSC and MSP promptly and carefully check all procedures and performance parameters involved in the APs for which they are specifically responsible. When this activity is completed the GOMS instability causes should be clearly identified and removed. Suitable tests shall be carried out jointly by the MSC and the MSP to confirm GOMS instability was definitively removed. If the duration of this GOMS instability exceeds an agreed time as specified in the MSPA, the relevant operational managers in charge for the MSC and MSP respectively, shall request, according to the severity of the problem, either directly or using specified escalation procedures, an immediate and appropriate revision of the previous agreed ACPL and all relevant APs. This revision must be invoked, independently of the agreed time and relevant periodical update as scheduled in the MSPA. It is to be emphasized that any data/information regarding the monitoring, assessment or measurement of each performance index during GOMS instability, and all localization and clearance details of problems, must be collected, recorded and reported according to the specifications contained in the MSPA.

2) If the MSPA does not exist, both MSC and MSP will promptly evaluate the technical-economical convenience of its implementation. Should both parties confirm this convenience, a specific MSPA shall be agreed on and managed according to the same MS/GOMS instability checks and removal operational procedures as described at item 1) above.

All principles contained in an MSPA are strictly related to the management of the agreed MS/GOMS. The structure and detailed procedures of an MSPA follow the general principles of the OPSG for the management of the GOMS. It is to be noted that the performance requirements of all parameters/indices in the MSPA for GOMS management are more stringent and require supplementary features compared to those at the time agreed/stipulated according to ITU-T Recommendation M.1539.

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[15] A list of useful information, based on the different nature of the events and their priority in information exchange between maintenance involved people, including MSC, is shown in ITU-T Recommendation M.1530. For telecommunications services, examples of procedures for the exchange of information with the customer is reported in ITU-T Recommendation E.440.

7 MSPA overview

7.1 MSPA Structure and basic process functions

The basic structure of an MSPA related to an MS usually consists of two parts. The first contains the general principles, scope, aspects related to its confidentiality and legal status, its reviewing periodicity, the signatures of responsible people within both MSC and MSP organizations and any further general information as needed (e.g. criteria to establish the contact points managing the MSPA, any possible escalation principles and relevant procedure). The second part contains the ACPL regarding the agreed MS performance parameters/indices to be monitored and verified at the MSCC within the involved OPSG. For example, some of these performance parameters/indices are: MS/GOMS Availability; Mean Time to Provide MS/GOMS (μTPMS); Mean Time to Restore MS/GOMS (μTRMS); Ready For MS/GOMS date (RFMS). The aforesaid ACPL normally includes: the definitions of all performance parameters/indices; the adopted monitoring and management criteria, including relevant data collection, recording and reporting procedures; performance measurements and any possible target value; additional information which is useful to easily operate and manage the MSPA (e.g. contact name details of people managing operational aspects of the MSPA, escalation points and relevant people, reference/historical data).

Any identified operational problem of the performance parameters/indices while managing an MSPA, must be classified in a set of indices of different types (e.g. technical, commercial) related to the reason and nature of this problem. These reasons should be then analysed in-depth and correlated with a certain number of topics or specific measures to be carried out, monitored, followed-up, reported and reviewed periodically after their introduction or implementation within the revised contract or informal agreement. These constitute "Action Points (APs)". Each AP contains characteristics (i.e. sub-activities) which are "basic"(BC) and "specific"(SC). Each BC is described with the following information: the whole description, scope, objectives, duration of time to be carried out, responsible people interested in all sub-functions needed in the different phases of the MSPA, any possible value of performance parameters resulting from specific assessments and/or measurements and the time when the AP should be periodically reviewed. Any necessary further information to complete the AP is part of the SC.

The following is some of the main important operational information:

1) Responsibility for the AP: Name(s) of the people who are responsible for the AP, MSPA signature, its implementation, coordination and reviewing. This information should also include all necessary contact points/person details to manage the whole MSPA (e.g. postal mail, telephone, facsimile numbers, paging, e-mail of all APs managers involved).
2) Operative duration (or validity) of the AP: i.e. start and end dates and in some cases the time and hours when the AP is planned to be completely carried out or reviewed.
3) Priority for the completion of the AP if a certain number of APs should be carried out simultaneously.
4) Detailed description of the AP, including all criteria for the assessment or measurement of its effectiveness.
5) Operative status of the AP, completed/discharged or ongoing.
6) Date of AP implementation, its periodical reviewing and its completion.

7.2 MSPA implementation and operation

Two main phases can be identified for the lifecycle of an MSPA:

1) Implementation phase: This phase, starts when either the MSC or the MSP present a formal request for the MSPA implementation and it ends when it is possible to start the MSPA operation. Therefore this phase produces a technical-commercial validation in order to

ascertain the real benefits of activating the new MSPA for both the MSC and the MSP. Furthermore, this phase is characterized by BCs which are constituted by relevant process functions and their mutual interactions during various phases ending with the effective initialization of the MSPA.

2) Operation phase: It represents the MSPA operational status, including either its "in operation" and "termination". It starts whenever the implementation phase is completed and it ends when both the MSC and the MSP agree to perform formally re-operations or terminations. During this operation phase, MSPA application of all rules, measures, ACPL reviewing and any other update of all involved criteria are carried out. This phase also implies the utilization of specified BCs during the various operations phases ending with the decommissioning of any involved ACPL, relevant APs and the formal termination of the MSPA itself.

For both the implementation and operation phases, the main BCs are described in 7.1.

7.3 MSPA Reference Model

Figure 1 shows the MSPA Reference Model. With reference to a determined MSPA for a specific MS, any selected ACPL contains a certain number of APs. Each AP is related to a certain specific time duration and it is associated with a defined number of resources, relevant processes and procedures. APs are performed according to a certain list of BCs (e.g. from BC 1 to BC m) and SCs (e.g. from SC1 to SCn). This list is common to all APs of each ACPL (i.e. to "N " APs for ACPL 1). A similar situation exists after a certain period and a revised or new plan is put in place. When the MSPA is terminated all resources are released for any other APs when necessary.

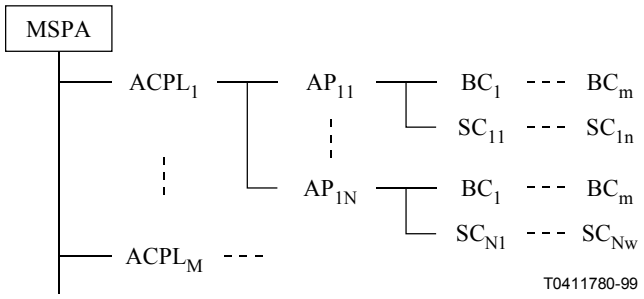


Figure 1/M.1532 – Reference model of MSPA

8 MSPA management

8.1 Objectives of MSPA management

Both an MSC and an MSP need to find out the most suitable way to assure an efficient MSPA management. The main objective of MSPA management is a continuous optimization of the total number of the MSPAs, their constituent ACPL(s) and relevant APs which may be simultaneously in place.

8.2 Brief overview of MSPA management

For any involved MS, once the relevant GOMS has been specified and agreed between an MSC and an MSP in a contract or in an informal agreement, it is provided by the MSP at the MSCC. In order to manage the agreed GOMS the adopted OPSG, together with a specified MSPA which is characterized by a particular ACPL, may or not be determined as integral part of the agreement.

Each of these actions is univocally and clearly defined and also their own deadline must be established. Both MSP and MSC continuously apply by their own the agreed criteria, methods, performance parameters/indices and the relevant limits/thresholds in order to carry out the GOMS assessment (i.e. specific measurements and evaluation) and the verification of its conformance to the agreed value/level. Whenever a situation of high and persistent instability of the GOMS exists, both MSC and MSP carry out all APs for which they are respectively responsible described in the MSPA.

At the completion of these actions both parties verify if the GOMS instability is still present or has been removed. If the GOMS stability is still critical, they must promptly agree further actions or, in some cases, agree quickly to a completely new ACPL through MSPA management.

Furthermore, as illustrated in Figure 2, which shows the MSPA management cycle for MSs, the continuous assessment of the GOMS value/target, implies that the MSPA which originally started to be operative at the implementation time "t_i" (i.e. MSPAt_i) is subsequently different at any other revision time "t_r" when it will be submitted to a verification to ascertain its validity and/or completion (i.e. MSPAt_r).

Referring to any MS, in order to identify univocally the functional block defining a specific MS/GOMS as agreed in a contract or in an informal agreement, it is necessary to define the following:

- MS type and relevant characteristics;
- MSC type and relevant characteristics;
- MSP type and relevant characteristics;
- OAM&P resources performance statistics;
- GOMS performance parameters/indices and their objectives;
- GOMS contract or informal agreement limits/targets;
- MSEs performance statistics;
- MSPA establishment and initiation of its management at the same time or after the contract or the informal agreement is stipulated.

When the MS/GOMS becomes effective, the MSPA at t_i is referenced to achieve the agreed GOMS. According to the MS/GOMS, both the MSC and the MSP perform monitoring, measurements, assessments, reporting and storage to assure the agreed GOMS achievement, while MSPA management takes place to apply the MSPA at t_i. Continuous activities taken by both MSC and MSP provide feedback to MSPA management on the validity of MSPA at t_i. When the revision of MSPA at t_i is requested by both the MSC and the MSP, a new MSPA at t_r is constituted. After installing this new MSPA, the MSC and the MSP resume activities to assure the agreed GOMS achievement.

Information that improved the MSPA is archived as "Recommended MSPA specifications" and it is applied to constitute or support MSPAs.

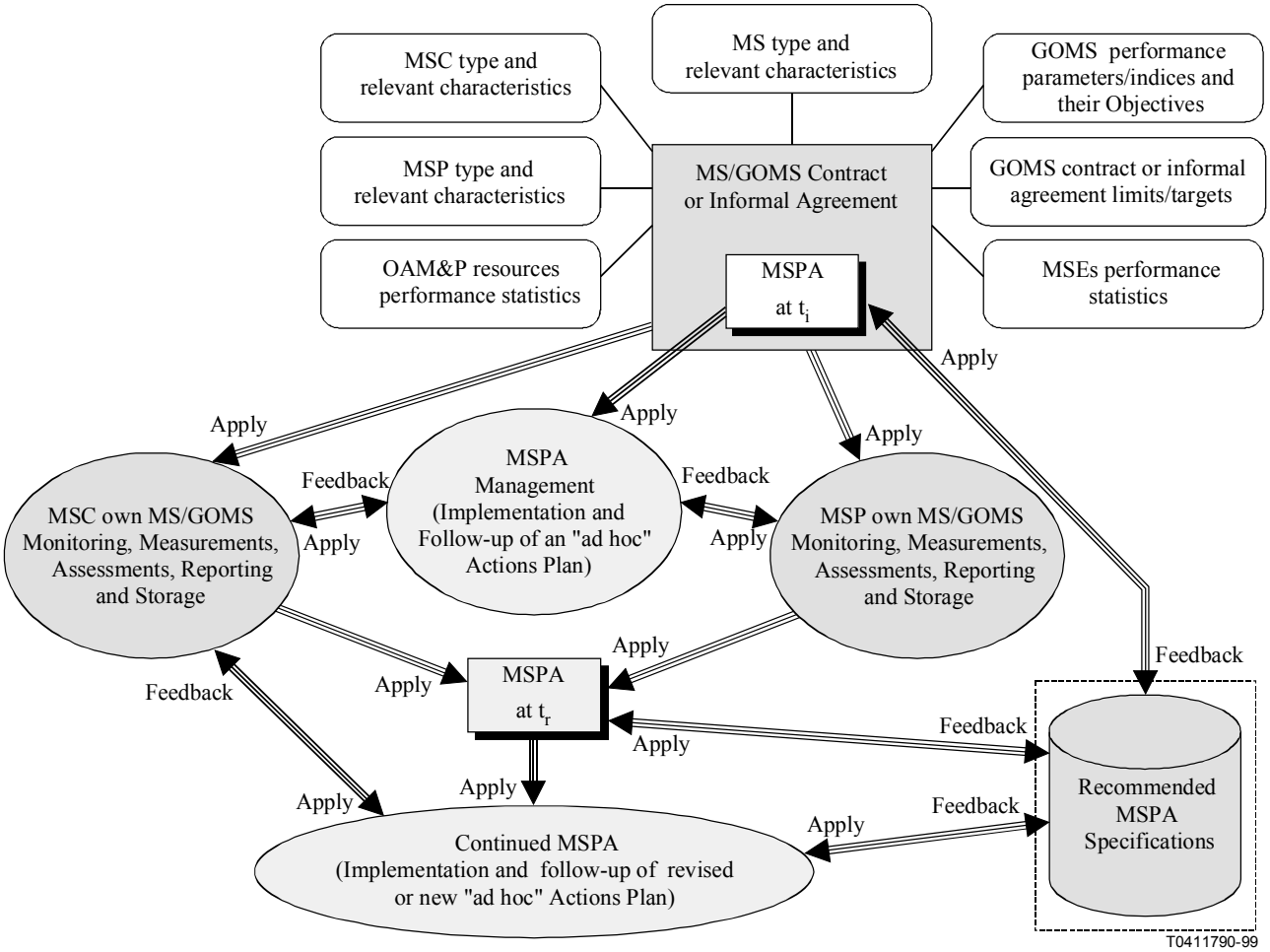


Figure 2/M.1532 – Overview of the MSPA management cycle for MSs

8.3 Criteria to be used for MSPA management

8.3.1 The MSPA Management Difficulty Index (MMDI)

For any MS and GOMS value objective as agreed between an MSC and an MSP in one or more MSPAs relevant to a specific amount of contracts and/or informal agreements, the associated MMDI[16] represents an overall index which permits, with respect to a stated and measured level of difficulty, to evaluate the probability to efficiently manage the real technical and economical convenience for the retainability of each existing MSPA or the implementation of a new one. The use of MMDI also allows to monitor continuously the achievement of GOMS objectives or its stability status. It is important to note that the "MSPA management efficiency" varies inversely with MMDI, i.e. when:

– "GOMS achievement (stability)" is good (MMDI low), "MSPA management efficiency" is high;

– "GOMS achievement (stability)" is bad (MMDI high), "MSPA management efficiency" is low.

[16] The definition and use of a similar "Difficulty Index" used for the optimization of the management of all network and human resources involved in the Maintenance domain, including the relevant processes and procedures, can be found in ITU-T Recommendation M.1230.

At any time "t", it is possible to define the MMDI as a set of suitable factors which may be expressed and combined with a more or less simple mathematical law of variation. The definition of these factors, their values, range of variation and their combination for MMDI computation mainly depend on the particular MS type/characteristics and the effective level of network performance and QoS, i.e. the GOMS which, according to specific business purposes, is agreed upon by an MSP and an MSC in an appropriate MSPA itself. The most used formula for the aforesaid combination of factors is a simple normalized formula where each factor "Yi" is specified as a function "Fi" of a specific index "Xi" related to a correspondent characteristic agreed in the contract or in the informal agreement. In some cases, the involved functions "F" may be the same either for a set or the total, of the "X" indices interested. Namely, at a certain time "t":

$$MMDI = \frac{\sum_{i=1}^{n} PiYi}{\sum_{i=1}^{n} Pi}$$

where:

1) Yi = Fi(Xi);

2) Pi = weight of the "i" factor Yi.

With reference to each type of MS, independently of the particular GOMS to be achieved and taking into consideration a generic average customer, a typical MSPA and relevant mean life-duration, the following are main technical and commercial factors which usually need to be considered for the MMDI definition and computation:

1) The overall cost of one MSPA or its average value, when several MSPA co-exist, per MSC;

2) The total number of contracts and informal agreements per MSC;

3) The total number of contracts and informal agreements with an MSPA per MSC;

4) The different types and total number of GOMS involved in all MSPAs, per MSC. For this factor, it is quite common and useful to practically establish a precise classification and limited number of possible achievable values of GOMS (e.g. using different scale indices);

5) The different type, level/threshold of the "MSPA management efficiency" per MSC, taking into account any additional cost which MSPAs may imply with respect to the cost of normal MS contracts or informal agreements (e.g. using different scale indices).

For a specific MS, one of the most simple and significant factor to assess, at any time, if both "GOMS achievement/stability" and "MSPA management efficiency" are good (MMDI low), is the current value of the "Percentage of MSPAs" over the total number of contracts or informal agreements which exist at that time for this MS. Namely:

$$\text{Percentage of MSPAs} = \frac{(\text{Total number of MSPA})}{(\text{Total number of contracts} + \text{informal agreements})} \times 100$$

The following two main conditions may occur:

– When this ratio is greater than a certain value or it has a positive trend towards 100% or it becomes equal to 100%, then GOMS values for all the MS contracts for each involved MSC are always quite unstable/critical to be achieved or there is a steady status where several MSCs are all requesting a contemporaneous GOMS improvement to the involved MSP.

  This condition corresponds to the highest probability to have a poor or bad MSPAs management efficiency. That represents the "worst case" to be avoided as much as possible, and which shall be promptly faced and removed because its permanence, will quickly lead to recurrent high new investments from the MSP in order to ensure continuous adequate adjustments of all involved MSEs, relevant processes and procedures of the selected OPSG.

– When the value of this ratio becomes low or very close to zero, it will imply that almost all agreed GOMS in the existing contracts or informal agreements are quite stable and their agreed objective values may be achieved without any particular difficulty. The continuous use of the MMDI also permits both the MSC and the MSP, to estimate with a good level of confidence, the success probability to continue managing efficiently the total number of MSPAs. As a matter of fact, this number is continuously varying because additional MSPAs may be required at any time. Taking into consideration that all factors of MMDI are strictly dependent on both technical and commercial - business aspects, its overall value may have a continuous fluctuation. Therefore, it is fundamental to follow the MMDI value according to any MS/GOMS specific change or new requirement.

9 Examples of MSPA

An MSPA may, in general, be applied to all GOMS with different scale (from a best to a poorest) and relative to specific MSs. The ACPL, and relevant APs constituting an MSP, are usually selected taking into account the MSC requirement, the MS type and also the particular telecommunication service characteristic to which it is normally applied. Some MSPA examples for MSs related to specific managed areas are reported in the Appendices I, II and III. These deal respectively with Leased Circuit Service (LCS), Videoconferencing and Internet services. A summary description of some main MSEs and relevant APs is provided in each appendix.

ANNEX A

Example of definition of MSPA Management Difficulty Index (MMDI)

This example refers to a case where an efficient MSPA management regarding a specific MS, can be made using a set of only four significant factors having the same weight (i.e. p=p1=p2=p3=p4) and also the possibility to use the same transform function F of the relevant four involved X indices is assumed (i.e. F=F1=F2=F3=F4) namely:

Four MMDI components:

1) MSPA ratio per total Agreements (contract + Informal Agreements) per MSC.	X1: MSPA existence index.	Y1 = F (X1)
2) MSPA to MS ratio per MSC.	X2: MSPA existence per MS index.	Y2 = F (X2)
3) MSPA to GOMS different scale ratio per MSC. Ratio to be calculated for each five GOMS scale levels [from (1) to (5)].	X3: MSPA existence per GOMS scale index.	Y3 = F (X3)
4) Mean additional cost for MSPA per GOMS different scale ratio per MSC, with respect to the similar mean cost without MSPA. Ratio to be calculated for each five GOMS scale levels [from (1) to (5)].	X4: MSPA cost index.	Y4 = F (X4)

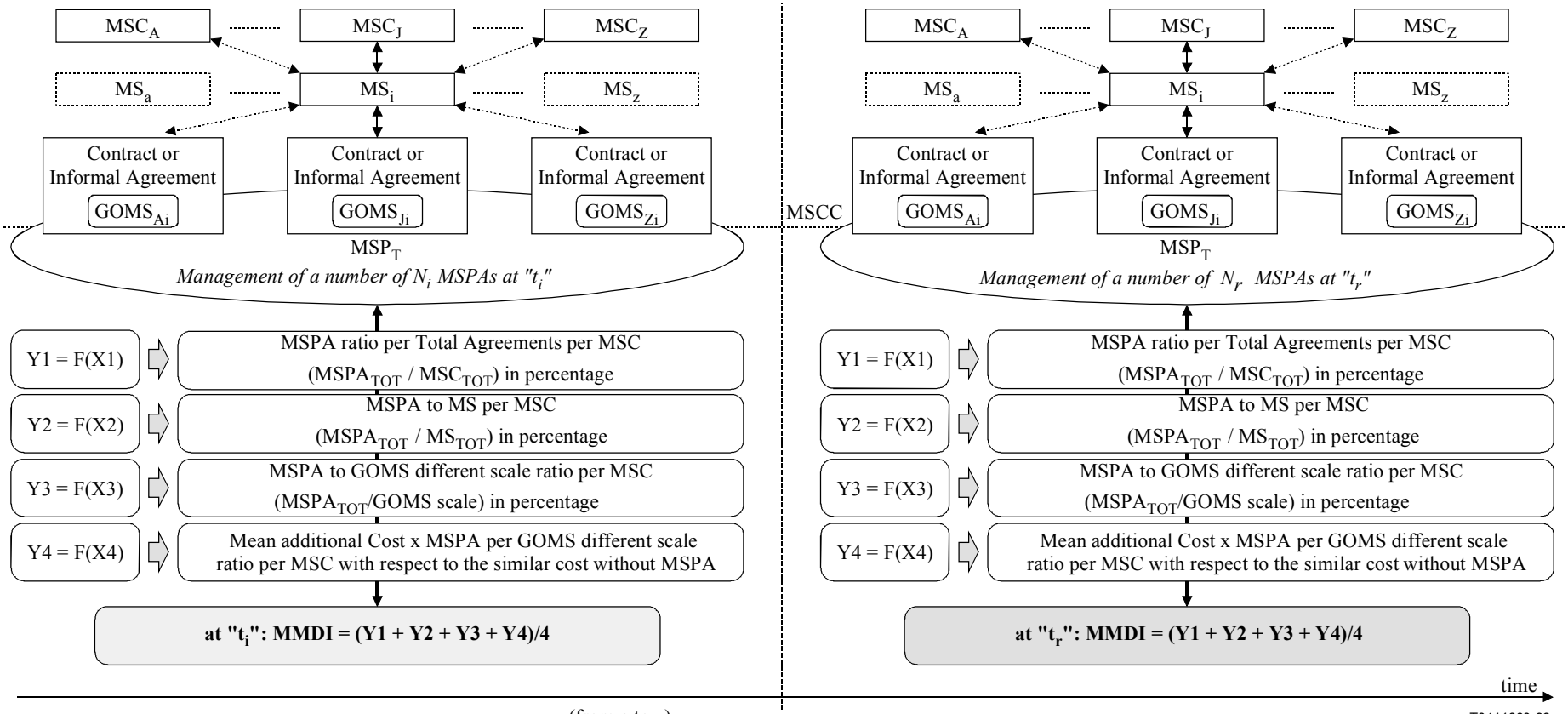
F transforms the four MMDI difficulty component values into an overall GOMS scale index which has a range from (1) to (5), that is:

GOMS scale index	Description
(1)	acceptable-excellent
(2)	acceptable-good
(3)	acceptable-sufficient
(4)	partially-unacceptable
(5)	completely-unacceptable

For each MSPA as involved, values of MMDI components can be computed. Then MSPAs (related to contracts and/or informal agreements) are classified into five different ranges according to these values. The MSPAs with the best MS/GOMS are assigned with the index (1) and the poorest are assigned with the index (5). In this way if MMDI is high, the MSPA management is inefficient, if MMDI is low, the MSPA management is efficient/good.

MMDI computation: MMDI = (Y1 + Y2 + Y3 + Y4)/4

Figure A.1 shows a general diagram of the MSPA management using this example of MMDI based on four significant factors. The concepts are represented at two different instants, i.e. the initial time "t_i", when the total number of MSPA to be managed is N_i and the revision time "t_r" when the same number is equal to N_r. In this case, as all four factors are also considered with the same weight, the MMDI can simply be expressed as their arithmetic mean.



MS	Maintenance Service
MSC	Maintenance Service Customer
MSCC	Maintenance Service Customer Contact point
MSP	Maintenance Service Provider
MSPA	Maintenance Service Performance Agreement
MMDI	MSPA Management Difficulty Index
GOMS	Grade Of Maintenance Service
t_i	implementation time
t_r	revision time

(from a to z)
(from A to Z)

(from K to T)

total number = N_i at the time "t_i" and N_r at the time "t_r"
at any time, an MMDI based on four components/factors is considered in this example
for the involved service "MSi " and for each MSC, only five different scale indices are considered in this example

Figure A.1/M.1532 – General diagram of MSPA management using an MMDI based on four components

APPENDIX I

Examples of MSPA for Maintenance Services (MSs) related to specific managed areas

Example of MSPA for MSs related to Leased Circuit Service (LCS)

I.1 Introduction

LCS provide proprietary data transmission capability (i.e. different transmission capacity) from an MSP to private business customers (MSCs). Some of the most significant MSPA issues regarding "MS Performance Monitoring", "MS Performance and Fault Management" and "MS Restoration" which represent the main Maintenance Services (MSs) in this communication services domain are shown in this appendix.

I.2 MS Performance Monitoring

I.2.1 Maintenance Service Elements (MSEs)

The following main MSEs constitute this MS:

– MSE1: To guarantee the availability of all network elements and any other equipment involved in normal conditions including all types of OAM&P functions and relevant procedures;

– MSE2: To ensure the availability of any redundant or spare part of the network elements including all OAM&P functions and relevant procedures;

– MSE3: To assure the capability of measuring any LCS performance parameters (e.g. US, ES, SES) including data collection, recording and storage for statistical purposes or any other subsequent action;

– MSE4: To monitor the correct operation of any centralized system (e.g. general main alarms for time synchronization failure).

I.2.2 MSPA for the GOMS

I.2.2.1 AP1: 24 hour basis continuous monitoring

When performance degradation is reported from an MSC, this action is taken to obtain times and occurrences of any unavailability event of all parameters related to network elements (e.g. Digital Access Cross Connection System, ADM, ADPCM, DCME, Network Termination Unit).

I.2.2.2 AP2: Spare equipment restoration

When the number of spare equipment becomes lower than a specified threshold which may impact the expected/designed value associated with the agreed GOMS, this action is taken to avoid the shortage of spare equipment.

I.2.2.3 AP3: MSCC availability verification

When problems in accessing and operating at the MSCC are identified, this action is taken to check and verify times and occurrence of problem accessing and operating at the MSCC (e.g. maximum delay to transfer and retrieve information on MS/GOMS states and relevant LCS performance values).

I.2.2.4 AP4: Monitoring data exchange

When performance data are requested, this action is taken to exchange or report any monitoring data result, and particularly those regarding special days or events of high priority or importance at the MSCC, within a specified time.

I.2.2.5 AP5: Performance monitoring in general

This action consists of in-service techniques and alarm monitoring and diagnosis. This action is taken when needed.

I.2.2.6 AP6: Interval reporting

This action makes all measurements and reporting on a specified time interval basis in order to facilitate correlation analysis of any MSE component behaviour and the LCS performance.

I.2.2.7 AP7: Out of service testing

Out of service techniques for assessing the cause for MSE performance degradation composes this action. This action is taken with a formalized acceptance of the MSC or when the LCS has returned to its original performance (e.g. through an automatic restoration of a faulty network or sub-network component of MSE involved in original LCS network configuration.)

I.2.2.8 AP8: Remedies/penalties

This action is taken when the mean time and rate of its performance degradation exceeds a specified value. In all cases the LCS degradation events shall be clearly due to performance degradation state that is localized in one or more of the network components constituting the MSEs.

I.2.2.9 AP9: Escalation procedures

In all degradation circumstances of a specified LCS, in a certain operation period, this action is taken only when:

– Specified thresholds of the absolute or average duration time of the LCS performance degradation time or its frequency, are exceeded. All LCS degradation events must be attributed to performance problems related to any component of the involved MSEs.

– Specified thresholds of the absolute or average duration time of the LCS performance degradation, or its rate, are identified without any reason or precise localization. All LCS degradation events must be attributed to performance problems related to any component of the involved MSEs.

I.3 MS Performance and Fault Management

I.3.1 Maintenance Service Elements (MSEs)

The main MSE of this MS is as follows:

– MSE1: To guarantee the availability of all network elements and any other equipment involved in normal conditions, including the correct application of all OAM&P functions and relevant procedures used for the correct operation of LCS.

I.3.2 MSPA for GOMS

I.3.2.1 AP1: Opening trouble ticket

When any performance index value is lower than the expected/designed value associated with the agreed GOMS, this action is taken to record the fault data and time of the event occurrence.

I.3.2.2 AP2: Trouble ticket management

Once the trouble ticket is opened, this action is taken. This action includes agreed procedures of Reception, Diagnostics, Undertake Repair and Clear-Close.

I.3.2.3 AP3: Fault report point establishment

When a fault occurs, this action is taken to establish a Fault Report Point (FRP) that provides 24 hours per day, 365 days per year, contact for operations entities of MSP and MSC.

I.3.2.4 AP4: Fault localization and restoration

When the FRP is established, this action is taken to initiate fault localization and restoration.

I.3.2.5 AP5: Fault reporting

When customer has a service fault, this action is taken by the customer to report about one of the following states:

1) Permanent and complete loss of the service;
2) Intermittent loss or degradation of the service.

I.3.2.6 AP6: Fault information exchange

When a particular investigation is needed, this action is taken to exchange fault information on circuits.

I.3.2.7 AP7: Fault-related information recording

When an initial contact to the FRP is made by the MSC, this action is taken to record the following information:

a) Name or identifier code of customer's organization;
b) Name of customer reporting the fault;
c) Contact details of the customer reporting the fault (e.g. telephone, facsimile, e-mail numbers);
d) Time of the fault report in UTC;
e) Circuit designation of faulty circuit;
f) Symptoms of fault;
g) Duration of fault as observed before the fault was reported;
h) Agreement with the customer that the circuit can be withdrawn from service.
i) How and where the fault was first noticed;
j) A fault reference number to be used in all future contacts.

Even if the fault is suspected to be within a network of a specific Network Operator/Service Provider, all fault reports must be communicated to the relevant remote Control Center or FRP (e.g. via telephone, facsimile).

I.4 MS Restoration

I.4.1 Maintenance Service Elements (MSEs)

The main MSEs of this MS are:

– MSE1: To provide additional restoration capability of all OAM&P resources (e.g. transmission capacity) used for the involved LCS in order to ensure the restoration to the original conditions whenever it is necessary;

– MSE2: To manage all operations required to restore the original MS capabilities and transmission capacity involved by the LCS.

I.4.2 MSPA for GOMS

I.4.2.1 AP1: Restoration expedition

When restoration time of capability is critical, this action is taken to speed up the Fault clearance. The mean time to restore the capability to operate all the interested LCS within a specified limit is used to capture the level of restoration. In addition, all tests are coordinated between the FRP and customer.

I.4.2.2 AP2: Circuit restoration

When a circuit restoration is necessary, this action is taken. The circuit restoration can be made using agreed automatic and/or manual plans. A restoration plan is an appropriate set of pre-arranged actions which are performed in case of failures.

I.4.2.3 AP3: Spare LCS use

When the unavailable time needs to be minimized, this action is taken. In this action the FRP uses a spare LCS and an additional monitoring period (e.g. three months) in order to ensure that the problem found was the only one that caused the fault.

APPENDIX II

Examples of MSPA for Maintenance Services (MSs) related to specific managed areas

Example of MSPA for MSs related to Videoconferencing service

II.1 Introduction

Videoconferencing service provides a multipoint videoconferencing capability from an MSP to registered customers (MSCs) on reservation basis.

II.2 Maintenance Service (MS)

"Guaranteed multipoint videoconferencing service" is a potential MS.

II.3 Maintenance Services Elements (MSEs)

The following MSEs and relevant performance indices constitute GOMS for this MS:

– MSE1: To guarantee the conference start time with performance indices, conference start time delay and number of conference operation troubles;

– MSE2: To identify trouble at customer site with performance indices, test achievement ratio and customer's trouble number;

– MSE3: To back-up customer conference site with performance indices, restored customer site ratio and additional resource allocation time.

II.4 MSPA for the GOMS

II.4.1 AP1: Videoconference quality improvement

When any performance index value is lower than the expected/designed value relating to the agreed GOMS, this action is taken to improve the service quality.

II.4.2 AP2: Videoconferencing user training

When the recovered customer ratio is degraded with respect to the value established to achieve the agreed GOMS, this action is taken to improve the customer ability to use videoconferencing facility.

II.4.3 AP3: Performance index value refreshing

When the average start time delay exceeds the agreed GOMS value and the quality improvement action is taken and confirmed, this action is performed to initialize evaluation process.

APPENDIX III

Examples of MSPA for Maintenance Services (MSs) related to specific managed areas

Example of MSPA for MSs related to Internet services

III.1 Introduction

Internet services provide data transmission capability of using IP to customers.

III.2 Maintenance Service (MS)

"Guaranteed data transmission service" is a potential MS.

III.3 Maintenance Services Elements (MSEs)

The following MSEs and relevant performance indices constitute GOMS for this MS:

– MSE1: To manage data transmission for a trunk network in terms of the lower bit-rate bound over a specified percent of specified duration, this MSE undertakes performance measurements including throughput and alarm monitoring of all resources involved in trunk network;

– MSE2: To manage data transmission for an access line network, this MSE undertakes performance measurement including throughput and alarm monitoring of access network.

III.4 MSPA for the GOMS

III.4.1 AP1: Performance improvement of trunk network

If the trunk network performance becomes lower than the expected/designed value relating to the agreed GOMS, this action is taken to improve the performance through cause analysis of low performance and appropriate actions such as network resource restoration.

III.4.2 AP2: Performance improvement of access network

If the access line network performance becomes lower than the expected/designed value associated with the agreed GOMS, this action is taken to improve the performance through cause analysis of low performance and appropriate actions such as network resource restoration.

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