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MAINTENANCE: INTRODUCTION AND GENERAL PRINCIPLES OF MAINTENANCE AND MAINTENANCE ORGANIZATION

MAINTENANCE PHILOSOPHY FOR TELECOMMUNICATION SERVICES

Recommendation M.21

FOREWORD

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Recommendation M.21 was revised by Study Group IV and was approved under the Resolution No. 2 procedure on the 5th of October 1992.

CCITT NOTE

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

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MAINTENANCE PHILOSOPHY FOR TELECOMMUNICATION SERVICES

(Melbourne 1988, revised 1992)

Abstract

This Recommendation describes the maintenance philosophy for telecommunication services. It also defines service maintenance phases, service supervision capabilities, and bringing into service requirements.

Keywords

– service;

– maintenance;

– quality of service.

1 General

Service maintenance is the combination of all technical and corresponding administrative actions, including supervision actions, intended to retain a service in, or restore it to a state in which it can ensure meeting the applicable Quality Of Service (QOS) requirements. In order to properly plan and develop the maintenance operations required to establish and maintain a telecommunication service, the following general strategy is recommended.

1.1 *Service maintenance objectives*

1.1.1 *Purpose*

Service maintenance objectives are to ensure that any deviations from defined Quality Of Service (QOS) factors and performance objectives will be corrected in timely fashion and to customer satisfaction. A concept of QOS is defined in Recommendation E.800 [1] as "the collective effect of service performances which determine the degree of satisfaction of a user of the service". QOS comprises a number of factors or performances which are enumerated and defined in Recommendation E.800 [1]. For this purpose Administrations may designate units within the existing maintenance organization or may establish new service maintenance organization units responsible for all aspects of service maintenance.

1.1.2 *Introduction of new services*

When a new service is to be introduced, early consideration should be given to its operational and maintenance requirements. In practice, these will depend on its Quality Of Service objectives, and therefore, on performance parameters and objectives which are set for each item which is used for operating the service (e.g. equipment, network, etc.). Thus each item should be considered individually. If such an item is unique to a service, there will be new operational and maintenance requirements. If such an item is not unique to a service and it is already used in providing an existing service, consideration should be given to whether the existing operational and maintenance requirements need to be changed. This will depend on whether the performance parameter objectives are changed.

1.1.3 *Interactive and coordinated maintenance activities*

Considerable benefits may be obtained by close cooperation between the network maintenance organization and service maintenance organization units. In the provision and maintenance of a service consideration should also be given whether subject areas require inter-Administration agreements or the development of specific Recommendations. In such a case, operational and maintenance responsibilities should be negotiated and established among all involved service providers prior to the introduction of such a service. Technical service, as defined in Recommendation M.75 [4], may need to be involved in making the appropriate agreements. Service maintenance contact points should be exchanged as part of the general exchange of contact point information as specified in Recommendation M.1510 [5].

2 Overall service maintenance philosophy

Service maintenance philosophy should encompass all components involved in service and their relationships.

2.1 *Service supervision capabilities*

Service supervision is a process in which anomalies and defects are detected, analysed and checked. This analysis may be internal or external to the entity. In the external case, it can be accomplished either locally or on a centralized basis. For maintenance, this supervision process has to include the following actions:

a) Locating the "failed" component, or the component in which a fault is suspected or a failure is believed to be affecting service operation. The service supervision process follows the network supervision process principles as defined in Recommendation M.20 [6]. However, the service supervision process is analysing anomaly and defect data related to service quality parameters and objectives. The thresholds of degraded or unacceptable performance limits and the process period, are defined for each defect, confirmed fault, or group of anomalies and defects, and also for each type of entity. Indications of degraded and unacceptable performance levels are generated each time the corresponding threshold is exceeded.

b) Reporting of failures or service degradations to maintenance personnel.

c) Protecting or restoring the service by automatic initialization of internal or external protection mechanisms, e.g. reconfiguration, traffic rerouting, etc.

2.2 *Relationships to network failure concepts*

Failure concepts specified in Recommendation M.20 [6] are applicable to service failure concepts, but they are not equal. Failure of a network equipment or capability may not cause service failure. This is because service function(s) may be automatically restored by using reconfiguration, rerouting capabilities, etc. However, such network equipment failures should be promptly repaired to ensure that subsequent failures will not cause service degradation or failure. The faults occurring in the telecommunication network are characterized by their impact on the service provided by the network. Three measures applicable to maintenance are specified in Recommendation E.862 [2]:

– duration of the fault (mean down time);

– mean traffic intensity affected by the fault;

– mean probability of congestion during the fault.

The seriousness of a fault also depends on how the customers experience the fault, and on the Administration's loss of revenue.

3 Bringing into service

3.1 *Verification of service from the network perspective*

All service functions should be verified by the service provider before making the service available. This verification should include the verification of network resources and operation of the service.

3.2 *Verification of service from the customer/user perspective*

The pre-service verification should encompass the service features (as purchased by the customer) and related operations procedures. It is recommended that pre-service verification be successfully conducted before releasing the service to a customer.

3.3 *Detailed considerations*

Given that the fundamental objective is to provide service in an acceptable time frame, meeting or exceeding customer expectations, detailed bringing-into-service procedures should be developed and implemented.

3.4 *Identification of responsibilities*

In multi-Administrations services the information resources will be distributed across all involved telecommunications networks. In order to provide good and timely support, responsibilities of all the Administrations should be clearly defined.

4 Maintenance phases

4.1 *Performance/quality surveillance*

The objectives of service surveillance are to detect anomalies, defects and faults affecting service quality. It is assumed that service performance criteria/parameters to be monitored (e.g. errored seconds for digital transmission, post-dialling delay for switched services) are known and established according to specific service requirements. This should also include the definition of normal, degraded and unacceptable values for these parameters. It should be noted that QOS parameters and target values for these parameters are defined in Recommendations which either define services or address specific implementation aspects; examples can be found in the E-Series, I-Series and Q-Series Recommendations.

All types of performance measurement specified in Recommendation M.20 (§ 5.1) [6] are applicable. In addition, other methods of measuring QOS may be used. These include test calls (simulated traffic), customer complaints (see Recommendation E.420 [7]) and customer interviews for opinions of QOS.

4.2 *Service degradation detection*

Performance data should be analysed to determine service status (e.g. normal, degraded, failed, etc.). Information on failure, unacceptable performance or degraded performance should be transmitted to the maintenance staff, operations systems involved in service/network maintenance, and other parts of the network when appropriate, to initiate proper action (e.g. report degradation or failure, request reconfiguration, etc.). Customer(s) may need to be informed when appropriate.

4.3 *Service restoration*

The objective of service restoration is to restore the service to an agreed service performance level. To achieve this, it is necessary to define an alternative way to restore the service (e.g. network reconfiguration). This alternative should be performed based upon information on the type of failure, including such information as identification of the failed component/equipment, or failed transmission link. Criteria for service restoration, such as, type of service to be restored and priority scheme, may also be made available. To make service restoration possible, Administrations should provide sufficient spare capacity in the network and/or backup equipment. Upon successful verification of the alternative configuration the affected service should be routed over that configuration.

4.4 *Service restoration time*

It is desired that the time taken for service restoration be kept to a minimum so that impacts of failures are minimized.

4.5 *Failure or performance information*

The principles for use of failure and performance information defined in § 5.4 Recommendation M.20 [6] are also applicable to service maintenance.

4.6 *Fault localization*

If the fault description is not adequate, additional fault localization and/or diagnostics will need to be performed. Once the fault is localized the fault correction/repair activity should be initiated.

4.7 *Fault recovery time*

Fault recovery time is a part of the overall down time of network resources, and includes active repair time and logistic delay. This time is a function of network maintenance procedures, maintenance organization efficiency, testing capabilities, etc. Repair of network resources may be carried out while the service is performing all required functions under an alternative configuration. Supplement No. 6 to CCITT Blue Book Fascicle II.3 [3] defines terms associated with dependability and time concepts and should be applied here.

4.8 *Fault correction*

The objectives of fault correction are to promptly repair the failed component and make it available for service. Fault correction may require dispatching maintenance personnel to replace/repair the failed unit (in case of a hardware failure), or the fault may be remotely corrected (in the case of a software failure).

4.9 *Verification*

After the fault has been corrected, checks must be made to ensure the service is working properly.

4.10 *Restoration*

After correction and verification, the service is restored to the original configuration. The alternative configuration is then released.

5 Additional maintenance activities

5.1 *Maintenance support*

The service providers' ability to efficiently deal with customer requests will rely heavily on their ability to communicate with all involved Administrations and on their ability to exchange in a timely manner: service, network operations and maintenance information which directly affects the customer. In order to meet this goal, efficient methods for information exchange between all involved Administrations are required (see Recommendation M.1520 [8]).

5.2 *Failure statistics*

For further study.

5.3 *Preventive maintenance*

For further study.

6 Other maintenance considerations

If the maintenance procedures do not successfully resolve the problem, an escalation procedure may be required (see Recommendations M.1550 [9] and M.1560 [10]). Service providers should also consider the unique aspects of international services such as time differences, language barriers, different technologies and standards, different network management methods and different market needs.

References

[1] CCITT Recommendation E.800 *Quality of service and dependability vocabulary.*

[2] CCITT Recommendation E.862 *Dependability planning of telecommunication networks.*

[3] CCITT Supplement No. 6 *Terms and definitions for quality of service, network performance, dependability and trafficability studies,* Blue Book, Fascicle II.3.

[4] CCITT Recommendation M.75 *Technical Service.*

[5] CCITT Recommendation M.1510 *Exchange of contact point information for the maintenance of international services and the international network.*

[6] CCITT Recommendation M.20 *Maintenance philosophy for telecommunication network.*

[7] CCITT Recommendation E.420 *Checking the quality of the international telephone service etc.*

[8] CCITT Recommendation M.1520 *Standardized information exchange between Administrations.*

[9] CCITT Recommendation M.1550 *Escalation procedure.*

[10] CCITT Recommendation M.1560 *Escalation procedure for international leased circuits.*