INTERNATIONAL TELECOMMUNICATION UNION

ITU-T E.413

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QUALITY OF SERVICE, NETWORK MANAGEMENT AND TRAFFIC ENGINEERING

INTERNATIONAL NETWORK MANAGEMENT - PLANNING

ITU-T Recommendation E.413

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation E.413 was published in Fascicle II.3 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

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

Recommendation E.413

INTERNATIONAL NETWORK MANAGEMENT – PLANNING

1 Introduction

1.1 Many situations arise which may result in anormally high or unusually distributed traffic levels in the international network, or loss of network capacity, or both. These situations include the following:

- peak calling days,
- failure of transmission systems (including planned outages),
- failure of exchanges,
- failure of common channel signalling systems,
- mass-calling situations,
- disasters,
- introduction of new services.

Experience has shown that advanced planning for these situations has a beneficial effect on overall network management efficiency and effectiveness. The timely application of planned control strategies can be instrumental in improving network performance.

1.2 For known or predictable events, predetermined network management plans should be developed and agreed between Administrations, bearing in mind the costs involved. The degree of detail of any plan will depend on the type of situation to be covered. For example, a recurring event such as Christmas or New Year's Day may be planned in great detail. The lack of real-time network management facilities in an Administration should not prelude planning activities.

1.3 When unforeseen situations arise for which predetermined plans do not exist, ad hoc arrangements will need to be agreed at the time. Whether network management actions result from a negotiated plan, or an ad hoc arrangement, it is essential that agreement be reached between Administrations concerned before such actions are actually implemented.

1.4 Network management planning is normally performed by the "network management planning and liaison" point (see Recommendation E.414).

1.5 Another aspect of network management planning is long-range planning for the development and introduction of new network management techniques and capabilities for surveillance and control. This includes the development of new or improved controls which may be necessary due to the introduction of new services or the transition to ISDN. These functions are normally performed by the "network management development" point (see Recommendation E.414).

2 Development of plans

2.1 A comprehensive network management plan would include some or all of the following, as appropriate:

- Key indicators or criteria which should be used to decide when a plan should be implemented.
- The identification of destinations or points likely to be affected, along with an assessment as to the likely impact on originating and/or terminating traffic.
- Control actions which may be required or that should be considered locally and in distant locations. This includes the identification of temporary alternative routings which may be available for use, and the modifications to automatic controls which may be necessary.
- Special call handling procedures to be used by operators, and notification requirements.
- Communication requirements. This includes identification of the necessary information flows between the network management centre and other organizations which may be involved or may have information concerning the problem (such as maintenance and operator centres).
- Data requirements. This includes determining what information may be relevant and where it is available.
- Key events or milestones. These are critical elements which can measure the success or progress of a plan, and indicate when certain actions should begin or end.

2.2 Regardless of the format or detail in a plan, it will not be fully effective unless it is readily available and understood by all who may be involved including other Administrations. This requires that network management plans be reviewed on a regular basis. Plans should be reviewed to ensure that they reflect changes or additions that may have taken place in the network since the plan was prepared. This is particularly important for plans which are used infrequently. Attention should be directed to changes in routing, the introduction of new circuit groups, new exchanges or common channel signalling, or the addition of new network management capabilities since the plan was first developed.

2.3 When developing network management plans, it is important that they be flexible and, if possible, contain a number of alternatives. This is necessary because a planned action may not be viable or available at a given time, for example:

- it may be under consideration for the same or another problem,
- it may already be in use for some other purpose,
- a planned transit point may not be available due to congestion or a lack of spare capacity to or from the transit point at the time.

3 Peak day planning

3.1 There are a number of days which give rise to heavy calling in the international network. These usually correspond to certain religious or national holidays. Plans should be developed for those holidays which have resulted, or are expected to result, in unusually heavy traffic.

Peak-day calling can result in significant and sustained blockages in the network. This can be caused by two factors:

- the average length of conversation on a peak day in many cases can be significantly longer than on a normal business day;
- the calling pattern (which is usually residential in nature) may be different than the normal pattern (which is usually business-oriented).

A combination of these factors can result in a network that is highly congested and which requires careful planning and extensive network management controls to optimize service and revenues.

It should be noted that many peak calling days may also be public holidays. As a result, staffing in telephone exchanges and administrative offices may be minimal and some traffic data and service measurements may not be readily available. These factors should also be considered in peak-day planning.

3.2 Peak-day plans may include information on the following, as appropriate:

- Network management staffing requirements and expected hours of operations, and the exchange of such information with other network management centres.
- Provision of temporary additional circuits.
- Directionalization of both-way circuits where appropriate.
- Temporary alternative routings to take advantage of anticipated idle capacity.
- Controls to inhibit alternate routing via transit points that are expected to be congested.
- Identification of anticipated hard-to-reach points and planned controls to reduce attempts to hard-to-reach points.
- Special calling procedures for operators, including the exchange of network status information with operator centres.
- Advance testing of new controls, or those infrequently used (including the testing of the rerouting to ensure proper operation and the ability to complete to a terminating number via the transit point).
- Consideration of limiting installation and maintenance activity just prior to the peak day to only essential work in order to insure that all available circuits and switching equipment are in service.
- Procedures to take into account special situations, such as inter-ISC circuit groups, circuit multiplication systems, etc.

4 Transmission system failure planning

4.1 The impact on service of the failure of an international transmission system will depend on a number of variables:

– the size of the failed transmission system and its relationship to the total network capacity;

– its loading (the number of channels that are assigned for use) (this may change frequently);

– the destinations and/or services assigned to the transmission system and their relationship to their respective totals (this may change frequently);

– the traffic intensity during the period from the onset of a failure until restoration or repair (this can vary significantly);

– the duration of the failure (this is usually unpredictable);

– the availability of restoration capacity (this can vary).

Thus, it can be seen that it is difficult, if not impossible, to predict the precise impact on service of a failure at a given point in time. However, recognizing the increasing size and loading of modern transmission systems, the impact of a failure on service can often be severe, and as a result, significant effort has been expended by Administrations to develop and refine transmission system failure restoration plans.

Experience has shown that network management actions can also play a significant role in minimizing the adverse impact of failures on service. However, it should be noted that these network management actions will usually complement or enhance a transmission failure restoration plan and do not necessarily supplant the need for such plans. For short duration failures, e.g., solar interference on satellites, network management plans may be the only viable solution.

4.2 When an international transmission system fails, network management and transmission restoration activities should proceed in parallel on a coordinated basis.

– The network management centre will become aware of the impact of a failure on service via its network surveillance capacity; in some cases, this will occur before the specific details of the failure are known. The network management centre can identify the affected routes, destinations and/or services. This information will guide the application of network management controls and may also be useful to the restoration control point (Recommendation M.725) in setting priorities for restoration.

– The first response of the network management centre should be to consider the use of temporary alternative routings in order to complete traffic which is being blocked by the failure. In many cases, these actions can begin immediately, before the decision is made to activate a transmission restoration plan.

– If significant congestion continues despite the expansive controls, protective controls should be considered. Emphasis should be placed on the identification of destinations that are hard-to-reach and the selective reduction of traffic to these points so that the remaining network can be used by traffic with a higher probability of success.

4.3 It is recommended that a network management plan for the failure of a major international transmission system should include the following, as appropriate:

– identification of destinations or points affected for originating and terminating traffic,

– temporary alternative routings which may be utilized to bypass the failure, and hours of availability,

– notification lists,

– special call handling procedures for operators,

– controls which may be required in connected networks,

– controls to be requested of distant network management centres,

– actions to be taken after fault correction to restore the network to its normal configuration,

– special recorded announcements to customers, when necessary.

5 International exchange failure planning

5.1 The impact on service of the failure of an international exchange will depend on a number of variables, which include:

– whether there is a single or multiple international exchange(s),

– the routing plan and the distribution of circuit groups among the international exchanges,

– the traffic intensity during the failure,

– the duration of the failure,

– the size (capacity) and the current loading of the failed exchange, and its relationship to the total international switching capacity.

In any case, the failure of an international exchange usually will have a severe impact on service. Network management exchange failure plans can provide considerable benefits during the failure by limiting the spread of congestion to connected exchanges and providing alternative ways of routing traffic to bypass the failed exchange.

5.2 It is recommended that a network management exchange failure plan should include the following information, as appropriate:

- general information about the exchange and its function in the network, including diagrams of the normal network configuration and the reconfigured network during a failure,
- actions to be taken to verify a total failure of an exchange to differentiate it from certain fault recovery actions in SPC exchanges which may, at first, appear similar,
- notification lists,
- initial control actions to be taken upon verification of exchange failure,
- additional control actions to be taken based on the prognosis of the failure,
- controls to be applied within the national network,
- controls to be requested of distant network management centres,
- modifications which may be required to automatic controls,
- sequence of control removal when the exchange is restored to normal operation.

5.3 It is recommended that network management exchange failure plans be reviewed and up-dated whenever a significant change in network configuration occurs, or at least annually. A network management exchange failure plan should be prepared for a new international exchange before it is introduced into the network.

6 Common channel signalling (CCS) failure planning

6.1 When a failure in the common channel signalling system interrupts the flow of traffic, the affected traffic may be diverted by network management controls to other unaffected circuits groups. It is preferable that these actions be planned in advance. These plans should identify the modifications to the automatic CCS flow control responses which may be required in the exchanges to permit the planned actions to be taken [for example, to change the normal programmed response to the receipt of a transfer prohibited signal (TFP)].

6.2 It should be noted that, as more of the international network converts to common channel signalling, the availability of potential alternative routing may become limited, which will increase the need for careful planning.

7 Mass-calling planning

7.1 Uncontrolled mass-calling has the potential to seriously disrupt calling in the network. However, with proper planning, the adverse effects of many mass-calling situations may be minimized. The key to success is advance warning and interdepartmental cooperation and planning.

This requires that the Administration be alert to potential mass-calling situations so that the proposed use of the network can be evaluated in advance to determine the potential for congestion. When congestion appears likely, alternative serving arrangements may be proposed, which may include the use of network management controls.

7.2 With widespread availability of call-gapping controls (see Recommendation E.412), certain mass-calling applications may be provided without harm to the network. The call-gap controls can be set at each exchange to limit outgoing calls to only the amount necessary to keep the called lines filled. It must be noted, however, that no mass-calling control strategy can prevent originating congestion and dial tone delays in local exchanges if a large number of customers simultaneously attempt to dial a service or specific number.

8 Disasters

Disasters can be natural (for example, a typhoon, an earthquake) or man-made (an airplane or railroad accident). These events can result in either damage to network facilities or in an extraordinary number of calls, or both. While it is difficult to predict such a disaster, the effects of a disaster on the telephone network can be predicted with some degree of accuracy and plans developed accordingly. These plans should include:

- contact and notification lists,
- control actions required locally and/or in other Administrations,
- arrangements for additional staffing and extended hours of operation.

(See Recommendation E.411, § 6.5.)

9 Planning for the introduction of new services

The introduction of new services in the network may result in new or unusual traffic flow characteristics, and/or unusual traffic demand, particularly when there is strong initial interest in the new service. Therefore, the potential impact on the network of a new service should be evaluated to identify where congestion or deteriorated service might occur, and to identify what special network management surveillance and control capabilities may be required. It is important that this analysis take place well in advance of the planned service availability date, so that the necessary modifications to the exchange and/or network management operations system software can be completed in a timely manner. This will help to insure that the necessary surveillance and control capabilities will be available when the new service is introduced.

10 Negotiation and coordination

10.1 Administrations should exchange information concerning their network management capabilities as part of the network management planning process. Specific plans should be negotiated in advance on a bilateral or multilateral basis, as appropriate. Negotiation in advance will allow time to fully consider all aspects of a proposed plan and to resolve areas of concern, and will permit prompt activation when needed.

10.2 The use of any network management plan must be coordinated with the involved Administrations at the time of implementation. This will include (as appropriate):

- determining that planned transit exchange(s) have switching capacity to handle the additional traffic,
- determining that there is capacity in the circuit group(s) between the planned transit point and the destination,
- advising the transit Administration(s) that transit traffic will be present in its circuit groups and exchanges,
- arranging for the activation of controls at distant locations,
- arranging for surveillance of the plan while in effect to determine the need to modify the plan.

When the use of a plan is no longer required, all involved Administrations should be notified of its discontinuance, so that the network can be restored to its normal configuration.