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**SERIES E: OVERALL NETWORK OPERATION,
TELEPHONE SERVICE, SERVICE OPERATION AND
HUMAN FACTORS**

**Quality of service, network management and traffic
engineering – Network management – International
network management**

International network management – Operational guidance

ITU-T Recommendation E.411

(Formerly CCITT Recommendation)

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OVERALL NETWORK OPERATION, TELEPHONE SERVICE, SERVICE OPERATION AND HUMAN FACTORS

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ITU-T RECOMMENDATION E.411

INTERNATIONAL NETWORK MANAGEMENT – OPERATIONAL GUIDANCE

Summary

Network management requires real-time monitoring of current network status and performance and the ability to take prompt action to control the flow of traffic when necessary (see Recommendation E.410). Operational guidance to meet these requirements, including a description of status and performance parameters, traffic controls and the criteria for their application are included in this Recommendation. It should be noted that the complete range of parameters and traffic controls are not necessary for the introduction of a limited network management capability; however, a comprehensive selection will bring substantial benefit (see clause 5/E.410). In addition, some guidance on beginning network management is provided, along with information on developing a network management centre and the use of common channel signalling for network management purposes.

Source

ITU-T Recommendation E.411 was revised by ITU-T Study Group 2 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on 13 March 2000.

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 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, the 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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Recommendation E.411

INTERNATIONAL NETWORK MANAGEMENT – OPERATIONAL GUIDANCE

(revised in 2000)

1 Scope

Network management requires real-time monitoring of current network status and performance and the ability to take prompt action to control the flow of traffic when necessary (see Recommendation E.410). Operational guidance to meet these requirements, including a description of status and performance parameters, traffic controls and the criteria for their application are included in this Recommendation. It should be noted that the complete range of parameters and traffic controls are not necessary for the introduction of a limited network management capability; however, a comprehensive selection will bring substantial benefit (see clause 5/E.410). In addition, some guidance on beginning network management is provided, along with information on developing a network management centre and the use of common channel signalling for network management purposes.

2 Information requirements

2.1 Network management requires information of where and why difficulties are occurring or are likely to occur in the network. This information is essential to identify the source and effect of a difficulty at the earliest possible time, and will form the basis for any network management action which is taken.

2.2 The information relating to current difficulties can be obtained from:

- a) real-time surveillance of the status and performance of the network;
- b) information from telephone operators as to where they are experiencing difficulties, or where they are receiving customer complaints of difficulties;
- c) transmission system failure indicators and planned outage reports (these reports need not relate only to the network local to one Administration, but should reflect the whole international network);
- d) international or national exchange failures and planned outage reports;
- e) news media reports detailing unforeseen events which stimulate traffic (for example, natural disasters).

2.3 The information relating to difficulties which are likely to occur in the future will be obtained from:

- a) reports of future planned outages of transmission systems;
- b) reports of future planned outages of international or national exchanges;
- c) knowledge of special events (for example, international sporting events, political elections);
- d) knowledge of national holidays and festivals (e.g. Christmas Day, New Year's Day);
- e) an analysis of past network performance.

2.4 The system availability information point, defined in Recommendation M.721, will provide a ready source for much of the information indicated above.

3 Network status and performance data

3.1 In order to identify where and when difficulties are occurring in the network, or are likely to occur, data will be required which will indicate the status and measure the performance of the network. Such data will require real-time collection and processing, and may require the use of thresholds (see 5.1).

3.2 Data may be collected in various ways which include counters in electromechanical exchanges which can be read manually when required (e.g. during periods of heavy traffic or special events), data output reports from SPC exchanges, or computerized network management operations systems which can collect and process data from a large number of exchanges.

3.3 Network status/performance information includes information on the status of exchanges, circuit groups, common channel signalling systems and transmission equipment. This status/performance information can be provided by one or more types of displays. These may include printers, video displays, and/or indicators/graphical representation on a display board or network management console. To be useful, network status indicators should be available as rapidly as possible.

3.3.1 Exchange status information includes the following:

- *Load measurements* – These are provided by attempt counts, usage or occupancy data, data on the percent of real-time capacity available (or in use), blocking rates, percentage of equipment in use, counts of second trials, etc.;
- *Congestion measurements* – These are provided by measurements of the delay in serving incoming calls, holding times of equipment, average call processing and set-up time, queue lengths for common control equipment (or software queues), and counts of equipment time-outs, etc.;
- *Service availability of exchange equipment* – This information will show when major items of equipment are made busy to traffic. This could highlight a cause of difficulty or give advance warning that difficulties could arise if demand increases;
- *Congestion indicators* – In addition to the above, indicators can be provided by SPC exchanges which show the degree of congestion. These indicators can show:
 - moderate congestion: level 1;
 - serious congestion: level 2;
 - unable to process calls: level 3.

NOTE – While this is desirable, SPC exchanges may not be able to provide a level 3 indicator during catastrophic failures.

- *Network management control status indicators* – Indicators can be provided to show controls that are active throughout a time interval, such as 30 seconds, or on occurrence to show controls that are added or deleted.

The availability of specific exchange status information will depend on the switching technology employed by each Administration. Details of exchange measurements are found in Recommendations E.502 and Q.544.

3.3.2 Circuit group status information relates to the following:

- status of service types;
- status of all circuit groups available to a destination;
- status of individual circuit sub-groups in a circuit group;
- status of circuits on each circuit group.

Status indicators can be provided to show when the available network is fully utilized by indicating:

- when all circuits in a circuit group are busy;
- when all circuits in a circuit sub-group are busy;
- when all circuit groups available to a destination are busy.

This would indicate that congestion is present or imminent. Status information can be provided to show the availability of the network for service, by reporting the number or percentage of circuits on each circuit group that are made busy or are available for traffic.

This information could identify the cause of difficulty or give advance warning that difficulties may arise as the demand increases.

An indicator should be provided to alert network managers, when the configuration or routing data is changed, for example, when a circuit group is deleted.

3.3.3 Common channel signalling system status provides information that will indicate failure or signalling congestion within the system. It includes such items as:

- receipt of a transfer prohibited signal (Signalling Systems Nos. 6 and 7);
- initiation of an emergency restart procedure (Signalling System No. 6);
- presence of a signalling terminal buffer overflow condition (Signalling System No. 6);
- signal link unavailability (Signalling System No. 7);
- signal route unavailability (Signalling System No. 7);
- destination inaccessible (Signalling System No. 7).

This information may identify the cause of difficulty or give advance warning that difficulties may arise as the demand increases. Details are shown in Recommendations E.415 and E.505.

3.3.3.1 Network management actions may help to reduce congestion in common channel signalling systems by reducing traffic being offered to common channel signalling circuit groups, or by diverting traffic to conventional signalling circuit groups.

3.3.3.2 Distant status information:

- information about congestion outside own exchange.

3.4 Network performance data should relate to the following:

- traffic performance for each circuit group (preferably by service type);
- traffic performance for each destination (preferably by service type);
- effectiveness of network management actions.

It may also be desirable to assemble performance data in terms of circuit group and destination combinations and/or traffic class (for example, operator dialled, subscriber dialled, transit). (See 2.1/E.412.) In case this data is not available, the call failure records or C7 signalling information might provide the relevant information in order to take the right network management actions.

3.5 Data collection should be based on a system of measurement which is either continuous or of a sufficiently rapid sampling rate to give the required information. For example, for common control switching equipment, the sampling rate may need to be as frequent as every second.

Reports on network status and performance should be provided periodically, for example, on a 3-minute, 5-minute, 15-minute, 30-minute or hourly basis, with the more frequent reports usually being more useful. However, the more frequent reports may produce erratic data due to the peakedness of traffic, especially on small circuit groups. Data reports compiled by a network management operations system take on added value in that a more global view of network performance is provided.