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CCITT E.415

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QUALITY OF SERVICE, NETWORK MANAGEMENT AND TRAFFIC ENGINEERING

INTERNATIONAL NETWORK MANAGEMENT GUIDANCE FOR COMMON CHANNEL SIGNALLING SYSTEM No. 7

Recommendation E.415

Geneva, 1991

FOREWORD

The CCITT (the International Telegraph and Telephone Consultative Committee) is a permanent organ of the International Telecommunication Union (ITU). CCITT 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 Plenary Assembly of CCITT which meets every four years, establishes the topics for study and approves Recommendations prepared by its Study Groups. The approval of Recommendations by the members of CCITT between Plenary Assemblies is covered by the procedure laid down in CCITT Resolution No. 2 (Melbourne, 1988).

Recommendation E.415 was prepared by Study Group II and was approved under the Resolution No. 2 procedure on the 23rd of August 1991.

CCITT NOTES

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

2) A list of abbreviations used in this Recommendation can be found in Annex B.

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1 Introduction

1.1 As the use of common channel Signalling System No. 7 increases, its performance becomes increasingly important to the network and the services it supports. Since problems in the signalling network can affect the switched networks that it supports, and vice versa, network managers must know the current status and performance of the common channel signalling network, as well as the various user application parts. This Recommendation provides guidance on the requirements for the surveillance of the status and performance of Signalling System No. 7 signalling networks.

1.2 Signalling System No. 7 uses signalling links for transfer of signalling messages between exchanges or other nodes in the telecommunication network served by the system. The system is designed to ensure reliable transfer of signalling information in the presence of transmission disturbances or signalling network failures. The system may be provided with redundancy of signalling links and includes functions for automatic diversion of signalling traffic to alternative paths in case of link failures. (The Q.700-Series of Recommendations contains complete information on the design and operation of Signalling System No. 7)

2 Surveillance of signalling network status and performance

2.1 There are a number of Signalling System No. 7 signalling network components whose status and performance are important to the network management function. These include:

a) signalling points:

   – signal transfer points;

   – exchanges;

   – intelligent network nodes.

b) signalling links;

c) signalling link sets;

d) signalling routes.

The status and performance of the various user application parts are also important. These include:

– Message Transfer Part (MTP)
(see Recommendations Q.700 to Q.704)

– Telephone User Part (TUP)
(see Recommendations Q.721 to Q.725)

– ISDN User Part (ISUP)
(see Recommendations Q.761 to Q.764)

– Signalling Connection Control Part (SCCP)
(see Recommendations Q.711 to Q.714 and Q.716)

– Transaction Capabilities Application Part (TCAP)
(see Recommendations Q.771 to Q.775)

– Operations and Maintenance Application Part (OMAP)
(see Recommendation Q.795)

2.2 All signalling points should make available signalling status and performance data (counts and occurrences of critical events) to their network management center and/or operations support system. The following categories of data should be provided:

– signalling link congestion status indicators;

– signalling link load and performance measurements (utilization and congestion);

– signalling link status indicators for the availability of links in a linkset;

– signalling linkset/route status indicators for the availability of each signalling linkset/route;

– user application part status indicators and load and performance measurements.

Each category is explained below.

2.2.1 *Signalling link congestion status indicators*

Signalling link congestion indications are significant in that they can identify the location and severity of the congestion. The onset of the transfer controlled (TFC) procedure is a key indicator of signalling link congestion.

There are two types of impact associated with link congestion; local and remote. Local impact includes those signalling messages that are discarded consistent with the local link congestion control strategy. Remote impact constitutes those signalling messages that are controlled at originating signalling points in response to the transfer controlled (TFC) procedure.

2.2.2 *Signalling link load and performance measurements*

Signalling link load and performance measurements are considered appropriate for the network management function and should be provided to the network management center and/or operations support system (see Recommendations E.502 and Q.791). It is recommended that these measurements be provided on a five minute basis.

Signalling link measurements can be used to anticipate signalling link load/utilization capacity problems in near real time, particularly when they are used with thresholds. Load measurement counts may be used to determine the anticipated short-term capacity of an individual link. The same measurements can be used to analyze the load balance among links of a link set. In some cases, a major component of the load might be retransmitted messages, and consequently the count of retransmitted octets can be used to identify this situation. Also important in this set of measurements are the number of messages removed due to signalling link congestion.

2.2.3 *Signalling link availability status indicators*

Status indications of link availability can be used to evaluate the potencial for linkset failure. For any linkset with more than one link, a single remaining available link represents a high potential for linkset failure. Out-of-service status on the links of a linkset can be used to determine the vulnerability of the signalling network to the potential loss of all links in that set, resulting in route unavailability, and the possibility of destination inaccessibility.

2.2.4 *Linkset/route availability status indicators*

A direct signalling route between any two adjacent signalling points is the linkset connecting them. The route is said to be available when at least one link in the linkset is available.

The loss of all links in a linkset will cause the direction seignalling route between the adjacent points to be unavailable.

In the extreme case, multiple concurrent unavailable routes will create a signalling network isolation, which occurs when there is no available signalling route between two adjacent signalling points (SPs). This results in a destination inaccessible condition.

The unavailability, restriction and availability of a signalling route is communicated by the transfer prohibited (TFP), transfer restricted (TFR) and transfer allowed (TFA) signals, respectively, Network managers must know when these conditions are present and when they have ended.

Note – A complete description of these and other internal signalling network management functions may be found in Recommendation Q.704.

2.2.5 Annex A to this Recommendation contains a listing of Signalling System No. 7 status indicators and load and performance measurements which are considered useful to the network management function. Additional details may be found in Recommendations E.502 and Q.791. The listing in Annex A is considered appropriate for a fully developed signalling network using a mesh network configuration. A selected sub-set of status indicators and measurements may be sufficient for smaller implementations.

2.2.6 *User application part status indicators and load and performance measurements*

Status indicators of user application part availability should be provided to the network management center and/or its operation support system. Analysis of user application part load and performance measurements may help to identify the source or nature of a problem and could give advance warning that difficulties could arise if the load increases. Annex A contains a listing of user application part status indicators and load and performance measurements which may be useful to the network management function. Additional details may be found in Recommendation E.502 and Q.791.

3 Response to common channel signalling network failures

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

As more of the international networks convert to common channel signalling, the availability of conventional signalling circuit groups may become limited. This further increases the need for careful planning.

3.2 In the case of catastrophic failure or overload of the common channel signalling network, where the pent-up demand is of such magnitude that the signalling network cannot recover by itself, it may be necessary to suppress some or all of the traffic being offered to the affected circuit groups until the signalling network can recover and stabilize. This can be done by the use of protective network management controls. Traffic can then be reintroduced by a gradual relaxation of the protective controls consistent with observed signalling network performance.

ANNEX A

(to Recommendation E.415)

A.1 *Signalling System No. 7 signalling network status indicators*

A.1.1 The following indicators of signalling network status are considered important for the function of monitoring signalling network performance. These indicators should be provided to the network management center and/or operations support system when they occur (see Recommendation Q.704):

- local automatic changeover/changeback;
- start/stop of remote processor outage;
- start/stop of signal link congestion;
- start/stop of adjacent signalling point inaccessible;
- start/stop of link set unavailability;
- start/stop of route set unavailability;
- receipt of transfer controlled message (TFC);
- receipt of transfer prohibited message (TFP);
- receipt of transfer restricted message (TFR) (national option);
- receipt of transfer allowed message (TFA).

A.1.2 In addition, the following user application part status indicators should be provided.

Note – User Application Part availability indicators may be implementation dependent:

- start/stop of local SCCP unavailability;
- start/stop of local ISDN User Part unavailability;
- start/stop of local TCAP unavailability;
- start/stop of local TUP unavailability.

A.2 *Signalling System No. 7 signalling network load and performance measurements*

A.2.1 Measurements indicated with an asterisk (*) could be provided by the use of thresholds, if desired, to reduce the volume of information provided in each measurement period.

A.2.1.1 *MTP load and performance measurements*

- *Per signal link:*

  a) counts of local automatic changeover/changeback;

  b) duration of signalling link unavailability;

  c) duration of signalling link unavailability due to remote processor outage;

  d) counts of remote processor outage events;

  e) counts of local management inhibit;

  f) duration of local management inhibit;

g)* number of octets retransmitted;

h)* number of message signal units (MSU) transmitted;

i)* number of message signal units received;

j) number of signalling link congestion events;

k) cumulative duration of signalling link congestion;

l) number of MSUs discarded due to signalling link congestion;

m) counts of TFCs received;

n) counts of TFPs received;

o) counts of TFRs received (national option);

p) counts of TFAs received.

– *Per signalling link set:*

a) duration of unavailability of signalling link set;

b) number of signalling link set unavailability events;

c) number of TFPs broadast events caused by failure of signalling link set (at STPs only).

– *Per signalling point:*

a) counts of events of adjacent SP inaccessible;

b) duration of adjacent SP inaccessible.

– *Per destination:*

a) counts of unavailability of route set to a destination or set of destinations;

b) duration of unavailability of route set to a destination or set destinations.

A.2.1.2 *SCCP*

a)* counts of routing failures – all reasons;

b) counts of start of local SCCP unavailable – failure [1)];

c) counts of start of local SCCP unavailable – maintenance made busy [1)];

d) counts of local SCCP unavailable – congestion [1)];

e) duration of local SCCP unavailability;

f) counts of total messages handled (from local or remote subsystems);

g) counts of total messages intended for local subsystems.

A.2.1.3 *ISUP*

a) counts of start of local USUP unavailability – failure;

b) counts of start of local ISUP unavailability – maintenance made busy;

c) counts of start of ISUP unavailibility – congestion;

d) duration of ISUP unavailability – all reasons;

e)* count of total ISUP messages sent;

f)* count of total ISUP messages received;

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1) These measurements are system architecture dependent.

g)* count of total unsuccessful attempts;

h)* count of unsuccessful call attempts – switching congestion;

i)* count of unsuccessful call attempts – no circuit available;

j)* count of unsuccessful call attempts – no route to destination;

k)* count of switching congestion signals received (by Originating point code OPC);

l)* count of no circuit available signals received (by OPC);

m)* count of no route to destination signals received (by OPC).

A.2.1.4 *TCAP*

a) counts of start of local TCAP unavailable – failure;

b) counts of start of local TCAP unavailable – maintenance made busy;

c) counts of start of local TCAP unavailable – congestion;

d) duration of local TCAP unavailable – all reasons;

e)* counts of total number of TCAP messages sent by the node (by message type);

f)* counts of total number of TCAP messages received by the node (by mesage type).

A.2.1.5 *TUP*

a) Counts of start of local TUP unavailability – failure;

b) counts of start of local TUP unavailability – maintenance made busy;

c) counts of start of local TUP unavailability – congestion;

d) duration of TUP unavailability – all reasons;

e)* count of total TUP messages sent by type of message;

f)* count of total TUP messages received by type of message;

g)* count of total unsuccessful call attemps;

h)* count of unsuccessful call attempts – switching equipment congestion;

i)* count of unsuccessful call attempts – circuit group congestion;

j)* count of unsuccessful call attempts – national network congestion;

k)* count of switching-equipment-congestion signals received (by OPC);

l)* count of circuit-group-congestion signals received (by OPC);

m)* count of national-network-congestion signals received (by OPC).

A.3 *Recommendation history*

First published 1991.

ANNEX B

(to Recommendation E.415)

Alphabetical list of abbreviations used in this Recommendation

ISUP	ISDN User Part
MSU	Message signal unit
MTP	Message Transfer Part
OMAP	Operations and Maintenance Application Part
OPC	Originating point code
SCCP	Signalling Connection Control Part
SP	Signalling point
STP	Signalling transfer point
TCAP	Transaction Capabilities Application Part
TFA	Transfer allowed
TFC	Transfer controlled
TFP	Transfer prohibited
TFR	Transfer restricted
TUP	Telephone User Part