



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

E.436

(03/98)

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

Quality of service, network management and traffic
engineering – Network management – Checking the
quality of the international telephone service

**Customer Affecting Incidents and
blocking Defects Per Million**

ITU-T Recommendation E.436

(Previously CCITT Recommendation)

ITU-T E-SERIES RECOMMENDATIONS

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

OPERATION, NUMBERING, ROUTING AND MOBILE SERVICES

INTERNATIONAL OPERATION

Definitions	E.100–E.103
General provisions concerning Administrations	E.104–E.119
General provisions concerning users	E.120–E.139
Operation of international telephone services	E.140–E.159
Numbering plan of the international telephone service	E.160–E.169
International routing plan	E.170–E.179
Tones in national signalling systems	E.180–E.199
Maritime mobile service and public land mobile service	E.200–E.229

OPERATIONAL PROVISIONS RELATING TO CHARGING AND ACCOUNTING IN THE INTERNATIONAL TELEPHONE SERVICE

Charging in the international telephone service	E.230–E.249
Measuring and recording call durations for accounting purposes	E.260–E.269

UTILIZATION OF THE INTERNATIONAL TELEPHONE NETWORK FOR NON-TELEPHONY APPLICATIONS

General	E.300–E.319
Phototelegraphy	E.320–E.329
ISDN PROVISIONS CONCERNING USERS	E.330–E.399

QUALITY OF SERVICE, NETWORK MANAGEMENT AND TRAFFIC ENGINEERING

NETWORK MANAGEMENT

International service statistics	E.400–E.409
International network management	E.410–E.419
Checking the quality of the international telephone service	E.420–E.489

TRAFFIC ENGINEERING

Measurement and recording of traffic	E.490–E.505
Forecasting of traffic	E.506–E.509
Determination of the number of circuits in manual operation	E.510–E.519
Determination of the number of circuits in automatic and semi-automatic operation	E.520–E.539
Grade of service	E.540–E.599
Definitions	E.600–E.699
ISDN traffic engineering	E.700–E.749
Mobile network traffic engineering	E.750–E.799

QUALITY OF TELECOMMUNICATION SERVICES: CONCEPTS, MODELS, OBJECTIVES AND DEPENDABILITY PLANNING

Terms and definitions related to the quality of telecommunication services	E.800–E.809
Models for telecommunication services	E.810–E.844
Objectives for quality of service and related concepts of telecommunication services	E.845–E.859
Use of quality of service objectives for planning of telecommunication networks	E.860–E.879
Field data collection and evaluation on the performance of equipment, networks and services	E.880–E.899

For further details, please refer to ITU-T List of Recommendations.

ITU-T RECOMMENDATION E.436

CUSTOMER AFFECTING INCIDENTS AND BLOCKING DEFECTS PER MILLION

Summary

This Recommendation addresses outages that result in "Customer Affecting Incidents" (CAI) and relates them to the call blocking Defects Per Million (DPM) metric for the switched network. It is discussed that these outages affect both the customers and the service provider in a significant manner. Definition of what constitutes a Customer Affecting Incident is presented. A methodology for tracking Defects Per Million metric is developed along with a recommended method for Root Cause Analysis. There are various parameters for exchanging network performance results among Administrations. CAI and DPM are additional performance parameters that may be exchanged to take network improvement actions.

Source

ITU-T Recommendation E.436 was prepared by ITU-T Study Group 2 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 9th of March 1998.

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.

INTELLECTUAL PROPERTY RIGHTS

The ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. The ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

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.

© ITU 1998

All rights reserved. No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the ITU.

CONTENTS

	<i>Page</i>
1 Introduction.....	1
2 References.....	1
3 Definitions of CAI and Blocking DPM.....	1
4 CAI classifications	2
4.1 Owned.....	2
4.2 Correspondent.....	2
4.3 Global Transport.....	2
5 Root Cause Analysis	3
6 Tracking CAI and DPM	3
6.1 CAI.....	3
6.2 DPM	3

CUSTOMER AFFECTING INCIDENTS AND BLOCKING DEFECTS PER MILLION

(Geneva, 1998)

1 Introduction

In switched networks, significant blocking can occur whenever there is a loss of capacity due to some form of network outage. These outages can be loosely called Customer Affecting Incidents or CAIs. CAIs cause focused blocking over and above those that occur due to engineered blocking. Calls blocked due to CAI can be termed "Defects". An appropriate network measure is the Defects Per Million (DPM) of call attempts.

CAIs are indications of a serious lack of reliability in international networks. CAIs directly impact customers in their ability to communicate. CAIs result in loss of revenue, and also affect the efficiency of network operations. Not only is time wasted in clearing troubles that could have been prevented, but also cause morale problems if they are chronic.

The root causes of CAIs can be due to many reasons:

- switching and transmission facility failures;
- power outages;
- process errors such as provisioning and maintenance errors.

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.

- ITU-T Recommendation E.801 (1996), *Framework for Service Quality Agreement*.
- CCITT Recommendation E.420 (1988), *Checking the quality of the international telephone service – General considerations*.
- CCITT Recommendation E.421 (1988), *Service quality observations on a statistical basis*.
- ITU-T Recommendation E.422 (1996), *Observations on international outgoing telephone calls for quality of service*.
- CCITT Recommendation E. 425 (1992), *Internal automatic observations*.
- ITU-T Recommendation E. 410 (1996), *International traffic management – General information*.
- ITU-T Recommendation E.411 (1996), *International traffic management – Operational guidance*.
- ITU-T Recommendation E.412 (1996), *Network management controls*.

3 Definitions of CAI and Blocking DPM

This Recommendation defines the following terms:

3.1 customer Affecting Incident (CAI): An incident is declared as a Customer Affecting Incident if it satisfies one of the following criteria. These are grouped into various categories as listed below:

- Transmission facility related:
 - More than X% of the direct-routed capacity to a country is lost due to some form of transmission capacity failure.

NOTE 1 – For well-trunked routes (say four uncompressed E1 worth of capacity), the value for X could for example be 10%. If the direct routed capacity is less than or equal to 1 T1 (i.e. twenty-four 64 kbit/s circuits) or 1 E1 (i.e. thirty 64 kbit/s circuits), 50% may be an example threshold.

- An incident lasts longer than M minutes and blocks more than $Y\%$ of calls.

NOTE 2 – For example the value of M could be 30 minutes and the blocked call threshold could be 50%. This case applies to situations where multiple destinations/terminations are affected.

- Switching, signalling or other equipment failures and software failures occur affecting call completion. Since these incidents should normally not occur and can have a huge impact, these should be counted in all cases.
- There is a provisioning, maintenance, network management, or new technology introduction process error. Since these incidents should normally not occur and can have a huge impact, these should be counted in all cases.
- There is a certain increased level of customer complaints with regard to call completion over and above the nominal level of complaints. These triggers may be able to catch chronic problems that may not be acute and may not be detected by network-oriented surveillance tools.

The Network Management (NM) Center or some other organization within an Administration may be utilized to keep count of the blocked call attempts from the beginning of CAI event till that event is cleared. Alternate routing, both automatic and manual, naturally reduce the impact of the CAI to some extent, but, in general, there can be a significant number of blocked call attempts.

3.2 number of CAIs: Number of CAIs is counted as the number of occurrences of CAIs on a daily, monthly (cumulative) and year-to-date (cumulative) basis.

NOTE 1 – CAIs should also be classified with respect to the level/severity of blocked calls to set priority for root cause analysis (see Clause 5).

3.3 defects per millions (DPM): Defects Per Million due to CAIs is counted as the ratio of blocked call attempts to total attempts in millions on a daily, monthly (cumulative) and year-to-date (cumulative) basis.

4 CAI classifications

CAIs may be classified as Owned, Correspondent or Global Transport.

4.1 Owned

These are CAIs caused by the actions of one's own Administration or those whose responsibility lies primarily with one's own Administration.

4.2 Correspondent

These are CAIs caused by the actions of the correspondent Administration or those whose responsibility lies primarily with the correspondent Administration.

4.3 Global Transport

These are CAIs caused by the actions of a Global Transport Administration or those whose responsibility lies primarily with a Global Transport Administration. Examples of Global Transport Administrations include Consortia that provide Satellite or Cable transport or those that provide restoration services.

Assignment of the responsibility for a CAI should be accomplished through mutual discussions between Administrations. The methods for reaching agreements on CAI assignments and further analysis could be part of Service Quality Agreements.

5 Root Cause Analysis

Root Cause Analysis (RCAs) help identify the root causes so that repetition of the problems can be prevented. RCAs could identify new technology bugs, gaps in testing, surveillance and monitoring, process errors and training gaps.

- In order to set some level of priority for Root Cause Analysis (RCA), thresholds should be established for the number of blocked calls: Any single event blocking more than N attempts requires a mandatory Root Cause Analysis. Each Administration should set the value of N based on their specific situation depending on the volume of traffic, the number of CAIs that would require an RCA and the amount of analysis resources that can be allocated, etc.

NOTE 1 – An example value of N is 2000. Approximately, 2000 blocked call attempts would result from a 3-hour outage of 30 uncompressed circuits, assuming 70% utilization and a retrial rate of 3 attempts.

- RCA is encouraged for CAIs caused by provisioning or maintenance process errors even if they block less than N call attempts. Such errors could mask an underlying problem that could potentially have had a much larger impact.
- A technology (i.e. a piece of network equipment such as a Mux, Modem, Connector, etc.) failure that occurs repeatedly (say, more than 3 times a year) also requires an RCA.
- RCAs are also encouraged for those CAIs that affect specific customers and are triggered by chronic customer complaints. In this case, the RCA followed by corrective action can result in direct improvement of customer satisfaction.

6 Tracking CAI and DPM

6.1 CAI

CAIs could be tracked on monthly and yearly basis to determine if the underlying network reliability is in a steady state, improving or deteriorating. These results could be shared as appropriate with partner Administrations based on the prevailing Service Quality Agreements.

6.2 DPM

Defects Per Million blocked call counts could be tracked by a variety of techniques including Statistical Process Control (SPC) charts. For example, if SPC is used, the basic approach would be to examine:

- a) if the DPM average over a period (month, quarter, year) is at an acceptable level;
- b) if the DPM variation is within control limits, i.e. the processes contributing to the defects are under control.

Corrective action should be taken if either the average or the variation exceed acceptable levels.

ITU-T RECOMMENDATIONS SERIES

Series A	Organization of the work of the ITU-T
Series B	Means of expression: definitions, symbols, classification
Series C	General telecommunication statistics
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	Transmission systems and media, digital systems and networks
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	Transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	Construction, installation and protection of cables and other elements of outside plant
Series M	TMN and network maintenance: international transmission systems, telephone circuits, telegraphy, facsimile and leased circuits
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Telephone transmission quality, telephone installations, local line networks
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks and open system communications
Series Y	Global information infrastructure
Series Z	Programming languages