INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

E.425
(03/2002)

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

Network management – Checking the quality of the international telephone service

Internal automatic observations

ITU-T Recommendation E.425

ITU-T E-SERIES RECOMMENDATIONS

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

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

ITU-T Recommendation E.425

Internal automatic observations

Summary

This Recommendation describes internal monitoring of network performance using specific performance parameters such as Answer Seizure Ratio (ASR), Answer Bid Ratio (ABR) and Network Effectiveness Ratio (NER). The advantages of internal monitoring is that a large volume of records can be collected which allows day-to-day evaluation of network performance.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. 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 Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 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

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. 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, 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.

CONTENTS

ITU-T Recommendation E.425

Internal automatic observations[1]

1 Definitions

1.1 essential information (of internal automatic observations)

The Answer Seizure Ratio (ASR) (see 1.3) or Answer Bid Ratio (ABR) (see 1.4), whichever is appropriate in terms of attempts, completed attempts and percentage completed.

The Network Effectiveness Ratio (NER) (see 1.5) provides a good indication of the ability of a network to deliver calls.

1.2 supplementary information (of internal automatic observations)

Information on signalling faults, subscriber behaviour and the network.

1.3 Answer Seizure Ratio (ASR)

ASR gives the relationship between the number of seizures that result in an answer signal and the total number of seizures. This is usually expressed as a percentage as follows:

$$ASR = \frac{\text{Seizures resulting in answer signal}}{\text{Total seizures}} \times 100$$

Measurement of ASR may be made on a route or on a destination code basis.

The *destination ASR* is calculated on the total amount of traffic to the destination whichever the outgoing route used.

A destination can be a mobile network, a country, a city, a service, etc. In the following example, the destination is a country. (See Figure 1.)

The most accurate view of the performance of the distant network is achieved by measuring direct ASR as indicated below.

Considering the traffic to a country B (i.e. the destination), the ASR to this destination is:

$$\text{Country B ASR} = \frac{\text{Direct + Indirect Seizures for country B resulting in Answers}}{\text{Direct + Indirect Total Seizures for country B}}$$

$$\text{Direct Country B ASR} = \frac{\text{Direct Seizures for country B resulting in Answers}}{\text{Direct Total Seizures for country B}}$$

$$\text{Indirect Country B ASR} = \frac{\text{Indirect Seizures for country B resulting in Answers}}{\text{Indirect Total Seizures for country B}}$$

---

[1] This Recommendation also applies in case external monitoring equipment is used when a route is monitored constantly for all or a large (statistical significance) number of calls. Refer to 2.4/E.421.
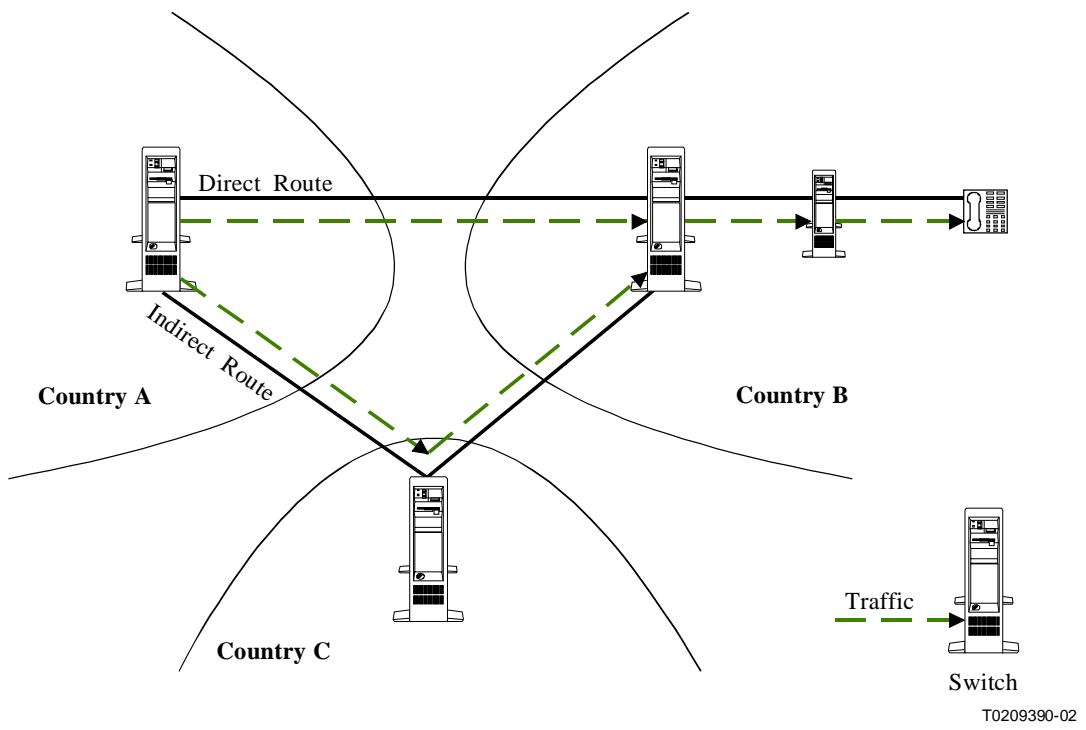
Figure 1/E.425 – Example of destination ASR

The *route ASR* is calculated on the total amount of traffic on an outgoing route whichever the destination of this traffic. (See Figure 2.)

Considering the traffic on a route c, the ASR on this route is:

$$\text{Route c ASR} = \frac{\text{Seizures on the route c resulting in Answers}}{\text{Total seizures on the route c}}$$
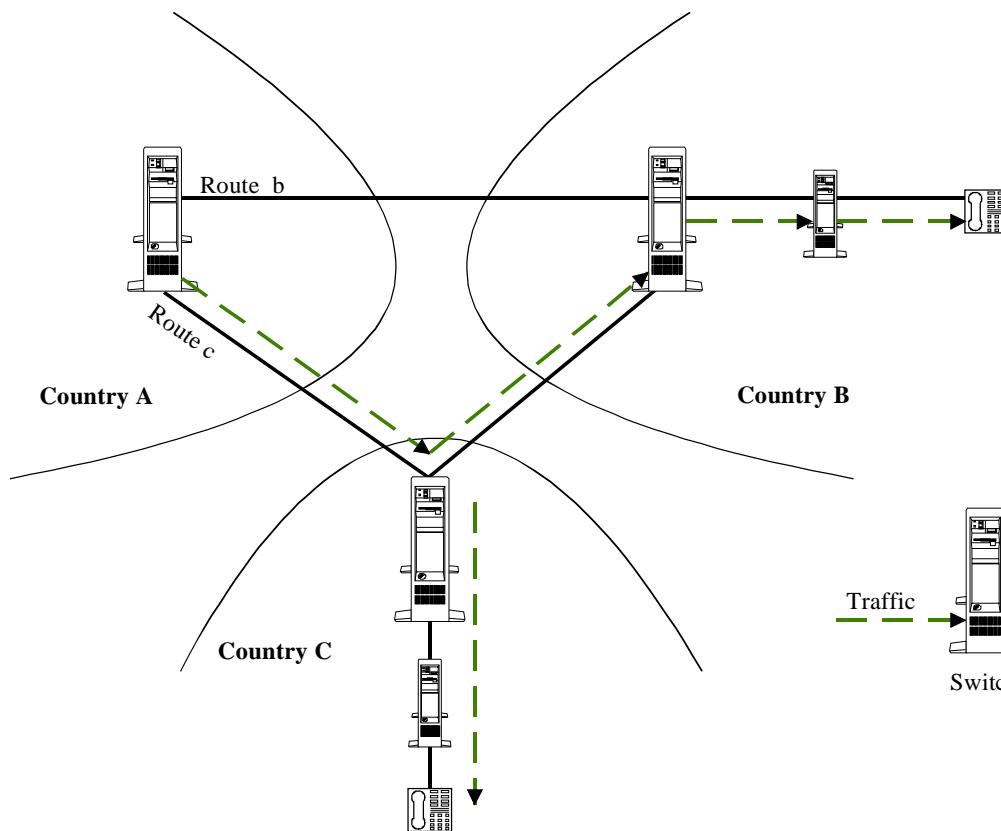
Figure 2/E.425 – Example of route ASR

1.4 Answer Bid Ratio (ABR)

Gives the relationship between the number of bids that result in an answer signal and the total number of bids.

$$ABR = \frac{\text{Bids resulting in answer signal}}{\text{Total bids}} \times 100$$

ABR is expressed as a percentage and is a direct measure of the effectiveness of traffic from the point of measurement. It is similar to ASR except that it includes bids that do not result in a seizure.

NOTE – There is not always a direct relationship between ASR and ABR since:

– some reattempts can be generated by the switch which can lead to a lower ASR than ABR;

– some bids can be lost by the switch which can lead to a lower ABR than ASR.

1.5 Network Effectiveness Ratio (NER)

NER is designed to express the ability of networks to deliver calls to the far-end terminal. NER expresses the relationship between the number of seizures and the sum of the number of seizures resulting in either an answer message, or a user busy, or a ring no answer, or in the case of ISDN a terminal rejection/unavailability. Unlike ASR, NER excludes the effects of customer behaviour and terminal behaviour.

Like ASR, measurement of NER may be made on a route or on a destination code basis (see 1.3).
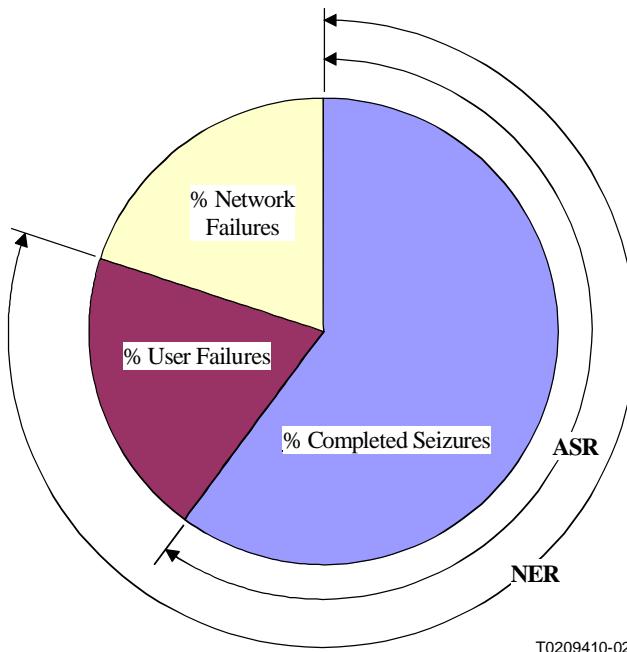
T0209410-02

$$NER = \frac{Seizures\ resulting\ in\ Answer\ message\ or\ User\ Failure}{Total\ Seizures}$$

See Annex A for Cause Value classification in User or Network failure category.

Remarks:

1)   Accurate measurement of NER is more complex than that of ASR.

2)   Accurate measurement of NER requires more complete signalling than does ASR.

3)   Cause values provided by ITU-T Signalling System No. 7 TUP and ISUP can be used as a basis for the measurement of NER. This type of data is usually available from systems that capture signalling information. It may also be available on Call Detail Records.

4)   Even if ITU-T Signalling System No. 7 is used on the international link, the use of other signalling systems in the domestic network or in transit network, and their interworking with the Signalling System No. 7 may impact the accuracy of the measure.

5)   If multiple exchanges are involved in the connection, accurate translation of the Cause values and Location across exchanges is necessary.

6)   NER should be regarded as a lower bound of the ability of a network to deliver calls. This is because it is not always possible to determine why calls were not delivered to the terminal. For example, a network vacant code could be caused by either customer dialling errors or network routing errors. Customer dialling errors that are not detected by network screening mechanisms will reduce the NER for that network.

7)   Call attempts that do not complete due to network screening should not contribute to NER. For example, a call attempt to a network vacant code caused by customer dialling error that is detected by screening shall not result in a seizure being counted for NER, and will not produce an answer, user busy, ring no answer or terminal reject disposition. Improved network screening can serve to increase the NER of a network.

8)   NER is calculated as a percentage of seizures, specifically, seizures of international circuits. A seizure will be said to have taken place, if the originating international switch has reserved a trunk for a specific call and has begun the signalling procedure to establish a call over that trunk.

9)   If an answer is received for a seizure, this seizure should be categorized as a network established call whatever the Cause Value received.

10)	If the location field contains the value LPN (private network serving the local user) or U (user) or RPN (private network serving the remote user), the seizure should be categorized as a network established call whatever the Cause Value received.

## 2	Merits of internal automatic observations

The advantage of internal monitoring is that a large volume of records can be collected. The large volume of data obtained from an internal observation system allows day-to-day evaluation of network performance. Daily analysis of this information has proven invaluable in trouble detection, and, coupled with a good maintenance response, is instrumental in providing the best possible Quality of Service[2]. The disadvantage is that this method does not have the capability of detecting tones or speech and therefore cannot present a complete representation of all call dispositions.

To overcome this disadvantage, Administrations are advised to use ITU-T Rec. E.422 as well to supplement the data obtained from internal automatic observations.

## 3	Time of observations

The results of the ASR, ABR daily profile should be recorded. This data can be hourly, in groups of hours, or a total day.

## 4	Exchange of the results of observations

4.1	The essential information[3] should be exchanged monthly (preferably by facsimile or telex) to all network analyses points of those Administrations who are interested (the analyses points can then make comparisons between different streams going to the same destination). If information on ASR or ABR can be supplied separately for direct routes and indirect routes via transit countries, this should also be exchanged as being essential information, including the name of the transit country involved.

4.2	With respect to supplementary data such as: signalling faults, failures due to calling subscriber, failures due to called subscriber and failures due to the network, a quarterly exchange of information is appropriate. Because different formats will be required, mail seems the most likely means to be used for exchanging supplementary data.

4.3	Besides the monthly and quarterly exchange of information, a direct contact on all aspects should be made (by telephone) as soon as action is required to prevent a persistent drop in the Quality of Service.

## 5	Classes of calls

The distinction between classes of calls (such as operator-operator, subscriber-subscriber and operator-subscriber) is considered useful in identifying problems relating to the Quality of Service. This can only be done if the language digit[4] and some of the subsequent digits are analysed.

---

[2]	Using these techniques, one can improve the quality of service even when no distinction can be made between ring no answer, subscriber busy (or congestion indicated by congestion tone) and recorded announcement.

[3]	The Administration supplying the data must indicate whether the ASR or ABR is used.

[4]	The language or discrimination digit is inserted automatically, or by the operator, between the country code (see ITU-T Rec. E.161) and the national (significant) number.

6 Destination analysis from service observation data

Consideration should be given to include the dialled digits, as observed by the monitoring equipment, in the exchange of information, especially for the sake of destination analyses (see Annex A/E.420).

7 Details about supplementary information for Signalling System No. 5

7.1 Signalling faults
– faulty signals;
– time-outs, the main item in this category being no proceed-to-send signal;
– busy flash (since busy flash is applied in many situations, including failures due to calling and called subscriber and the network, it is considered useful to distinguish between busy flash received within 0-15 seconds, 15-30 seconds and after 30 seconds when making destination analysis).

7.2 Ineffective calls associated with the calling subscriber

Premature release, to distinguish between release before or after having received ringing tone; equipment which can detect audible signals is required.

7.3 Ineffective calls associated with the called subscriber

Ringing tone no answer cannot be detected without equipment which can detect audible signals.

7.4 Network

Here only the busy flash can be detected without equipment which can detect audible signals.

8 Equipment impact

8.1 Administrations are recommended to consider inclusion of appropriate facilities in existing and new exchanges to record all or some of the following phases:

a) Calls switched to speech position, then:
   1) answered;
   2) unanswered, but released by calling party;
   3) timed out awaiting answer;
   4) a call failure signal (busy flash or equivalent) received;
   5) timed out after clearback signal;
   6) faulty signal received after answer.

b) Calls failing to switch to speech position:
   1) clear forward signal received;
   2) insufficient digits received;
   3) congestion on international circuits;
   4) faulty signals received into exchange;
   5) signalling fault into next exchange;
   6) time out while signalling to next exchange;
   7) congestion signal received from next exchange;
   8) vacant number received;

9) busy subscriber signal received;

10) line out of order signal received;

11) transferred subscriber signal received.

As a minimum requirement, one should be capable of determining the Answer Seizure Ratio (ASR) or the Answer Bid Ratio (ABR). This recording can be done by off-line processing of call records if they contain some more information than the information already required for international accounting.

8.2 Another way to assemble date on the Quality of Service (QoS) on outgoing circuit groups is through event counters. Five event counters already give a reasonable amount of information, three of them being common to Signalling Systems No. 5, No. 6 and R2: seizure, answer and busy signals[5].

Signalling System No. 5

The number of:

– seizing signals sent;

– end-of-pulsing (ST) signals sent;

– proceed-to-send signals received;

– busy flash signals received;

– answer signals received.

Signalling System No. 6

The number of:

– Initial Address Messages (IAMs) sent;

– congestion (switching-equipment; circuit groups; national network) signals, call-failure signals and confusion signals received;

– address-complete (subscriber-free, charge; subscriber-free, no charge; subscriber-free, coinbox; charge; no charge; coinbox) signals received;

– answer (charge; no charge) signals received.

Signalling System R2

The number of:

– seizing signals sent;

– congestion [national network (A4 or B4); international exchange (A15)] signals received;

– address complete (charge; subscriber's line free, charge; subscriber's line free, no charge) signals received;

– subscriber line busy signals received;

– answer signals received.

---

[5] In case the event counting is used to analyse the quality of service to a particular destination, the counting should be done separately for each signalling system.

Annex A

Cause value categorization

"*Cause value*" field, provides a precise indication of the event that causes the release of a connection (in every phase of the call). International standard ISUP protocol defines several different values for "Cause value" field (ITU-T Rec. Q.850). A classification of call failure causes based on "Cause value" field is indicated in Table A.1; in this table the CV codes are classified in three classes:

• User;

• Network;

• Call completed.

NOTE − It is important to note that this classification is theorical and that in practice, some CV categorized as a user failure can be in reality a network problem.

**Table A.1/E.425 – Meaning and classification of CAUSE VALUE field
in RELEASE ISUP message or CCS#7 signalling**

CV	Description	Class
1	Unallocated (unassigned) number	**User**
3	No route to destination	**Network**
4	Send special information tone	**Network**
16	Normal call clearing	**Call completed**
17	User busy	**User**
18	No user responding	**User**
19	No answer from user (user alerted)	**User**
20	Subscriber absent	**User**
21	Call rejected	**User**
22	Number changed	**User**
27	Destination out of order	**Network**
28	Invalid number format (address incomplete)	**User**
29	Facility rejected	**Network**
31	Normal, unspecified	**Call completed**
34	No circuit/channel available	**Network**
38	Network out of order	**Network**
41	Temporary failure	**Network**
42	Switching equipment congestion	**Network**
43	Access information discarded	**Network**
44	Requested circuit/channel not available	**Network**
46	Precedence call blocked	**Network**
47	Resource unavailable, unspecified	**Network**
50	Requested facility not subscribed	**User**
53	Outgoing calls barred within CUG	**User**
55	Incoming calls barred within CUG	**User**

**Table A.1/E.425 – Meaning and classification of CAUSE VALUE field
in RELEASE ISUP message or CCS#7 signalling**

CV	Description	Class
57	Bearer capability not authorized	**User**
58	Bearer capability not presently available	**Network**
62	Inconsistency in designated outgoing access information and subscriber class	**Network**
63	Service or option not available, unspecified	**Network**
65	Bearer capability not implemented	**Network**
69	Requested facility not implemented	**Network**
79	Service or option not implemented, unspecified	**Network**
87	User not member of CUG	**User**
88	Incompatible destination	**User**
90	Non-existent CUG	**User**
95	Invalid message, unspecified	**Network**
97	Message type non-existent or not implemented	**Network**
99	Information element /parameter non-existent or not implemented	**Network**

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of 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	Cable networks and 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 and Internet protocol aspects
Series Z	Languages and general software aspects for telecommunication systems