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# ITU-T

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

Quality of service, network management and traffic engineering – Traffic engineering – Measurement and recording of traffic

## Traffic measurement by destination

ITU-T Recommendation E.491

(Previously CCITT Recommendation)

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# ITU-T RECOMMENDATION E.491

# TRAFFIC MEASUREMENT BY DESTINATION


## Summary

This Recommendation outlines two approaches to destination-based measurement: call detail records and direct destination measurements. Three different methods of using call detail records are explained.


## Source

ITU-T Recommendation E.491 was prepared by ITU-T Study Group 2 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 26th of May 1997.

## FOREWORD

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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/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.491**

# TRAFFIC MEASUREMENT BY DESTINATION

*(Geneva, 1997)*

## 1 Scope

This Recommendation outlines two approaches to destination-based measurement: call detail records and direct destination measurements. Three different methods of using call detail records are explained.

## 2 Introduction

Traditionally, traffic measurements form network planning and other purposes have been taken on a circuit group basis. These measurements could be used directly for circuit group administration, and, for hierarchical networks, can be combined with pre-defined routing information to approximate point-to-point traffic matrices.

However, these measurements do not allow accurate evaluation of end-to-end blocking, and thus, do not reflect the quality of service perceived by customers.

In addition, with widespread use of network management controls and dynamic routing where the concept of final trunk groups vanishes, destination-based measurements are required to allow evaluation of network performance and Grade of Service (GOS).

The use of destination-based traffic measurements can be beneficial in all three cycles of network operations which are described in Recommendation E.490. Because service problems are identified directly, trunk group additions and adjustments become straightforward and so do network traffic management actions.

It should be noted that the advent of multi-service integrated networks will require that data measured on a destination basis be further split into classes of service. This will be necessary in order to ensure service specific performance objectives in an environment where each service has its own traffic characteristics.

## 3 Terms and definitions

This Recommendation defines the following terms.

**3.1 call detail record (CDR)**: Is an instance of measurement by destination using incoming traffic. CDRs may be done on sampling basis but can also be made continuously. The term Call Record (CR) in Recommendation E.502 means the same as a CDR.

**3.2 direct destination measurement**: Produces similar information to CDR measurement but by monitoring outgoing traffic.

**3.3 chargeable calls**: comprise completed calls and other kind of calls which are charged for a particular reason, e.g. some call attempts may be charged even if the call is not completed.

**3.4 unchargeable calls**: Call attempts which are not charged are called unchargeable calls.

**3.5 clearing code in a CDR** is:

– for unsuccessful call attempt (term used in Recommendation E.502) the cause for failure specified by E.502 type 16;

– for successful call attempt (term used in Recommendation E.502) the result of call attempt as specified by E.502 type 16.

**3.6 clearing between operators**: Means exchanging traffic information between operators for billing purposes.

**3.7 toll-ticketing**: Is an alternative way to pulse charging for billing calls. Toll-tickets are made for chargeable calls. An all-ticket differs from a toll-ticket by being made for all call attempts, not only for chargeable calls.

Other terms and definitions are given in Recommendation E.600.

## 4 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.

– CCITT Recommendation E.502 (1992), *Traffic measurement requirements for digital telecommunication exchanges.*

– ITU-T Recommendation E.600 (1993), *Terms and definitions of traffic engineering.*

– CCITT Recommendation E.490 (1992), *Traffic measurement and evaluation – General survey.*

## 5 Measurement from call detail records

### 5.1 Description

There are three kinds of call detail records:

A A CDR which is not used as a ticket but is made for only traffic measurement purposes, possibly on sampling basis.

B A CDR which is created for every chargeable call (toll-ticket).

C A CDR which is created for every call attempt, whether charged or not (all-ticket).

**Creation of CDRs**

CDRs of type A are created for incoming calls in exchanges selected for traffic engineering purposes.

The CDRs for billing (types B and C) are made in the originating exchange[1].

When necessary, CDRs of types B and C are made in transit exchanges for clearing between operators and for monitoring the transit traffic of individual operators. This information for clearing between operators and traffic studies is often collected using counters but it can also be made with CDRs.

A CDR of types B and C is created for occupations longer than some given T or when a cost limit is reached.

**Contents of CDRs**

For details of information to be recorded, reference is made to measurement types 15 and 16 in Recommendation E.502. The times in a CDR should be recorded in a precision determined by the application of the measurement. (Measurements for delay calculation would require considerably more precision than those for billing purposes.) In CDRs of types B and C the size of the ticket should be rather small for performance reasons.

**Procedure to process CDRs**

i) CDRs of type A and those CDRs of type B which are created in origination exchange[1] are handled as follows:

The CDRs are stored locally, until sent or polled from a central area for direct access or downstream batch processing.

ii) Type C: CDRs which are created in originating exchange[1] are handled as follows:

The CDRs must be divided into chargeable and unchargeable call CDRs in the originating exchange, or another way is that this exchange only contains a small buffer which is being polled with a short polling interval. Unchargeable call CDRs may be further divided into subsets according to the clearing code.

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1 Or in some other exchange which has been selected as a point where tickets are created.

CDRs for calls with a given clearing code are stored into logically separate files or databases, physically it may be the same database or file depending on the implementation. The CDR information is kept for a certain time depending on the clearing code. This time may vary from zero to relatively long times.

The CDRs for chargeable calls are stored in a file or database and from there they are transferred, for instance once a day, to a billing system, from where information for billing and customer traffic studies is obtained.

Unchargeable call attempts also get a CDR with a clearing code and the CDRs are transferred almost immediately to a traffic monitor where they are treated according to the clearing code.

In a fault situation the exchange, or the unit polling the exchange if the exchange is not checking the clearing code, can automatically limit the flow of unsuccessful calls coming to the traffic monitor by taking a random sample.

iii) Types B and C: CDRs which are created in transit exchanges can be handled as follows:

CDRs from chargeable calls are stored into a file in the exchange or after exchange in a similar way as in ii). The CDRs are transferred in suitable intervals to be processed for clearing between operators and traffic studies.

**Processing time for CDRs**

CDRs from chargeable calls are used for billing, clearing between operators and for traffic studies, all CDRs are usually processed but the processing period can be long, for instance a day.

The following two paragraphs apply to type C (all-ticketing):

Division of CDRs to those originating from chargeable calls versus unchargeable call attempts by checking the clearing code must be made continuously or with a short period. The period is determined by the needs of network management for treating unchargeable call attempts.

CDRs for unchargeable call attempts are processed by network management and they should be processed almost in real-time. During a period of low traffic it could be conceivable that unchargeable CDRs are not processed, this may not be a good practise since predicting silent periods is likely to be more uncertain in the future.

## 5.2 Application

The CDR information can be used for GOS statistics, billing and revenue settlements but also for various traffic measurements. If all-ticketing is used, CDRs can be used also for network management.

Using an off-line system, a large variety of traffic measurements such as Erlang loading, 24-hour traffic distribution, call duration, set-up time, conversation time, Answer Seizure Ratio (ASR), GOS and overflow, can be derived from the CDR. If all-ticketing is used, several interesting GOS parameters, like the number of failures from a given originating subscriber to a given destination subscriber can be obtained from CDRs.

These measurements can be computed by either origin, using the inlet source, or by destination, using the dialled digits, for both terminal and transit traffic.

Each measurement can be further broken down by exchange, trunk group, circuit, area code or even customer number.

The use of off-line reference tables to indicate the foreign country, city, exchange, the signalling type, facility type, etc. allows an almost unlimited flexibility in the sorting and grouping of the statistics extracted (i.e. by country, alternate route, high usage, final).

To avoid the double counting of traffic, any call records for calls switching through more than one exchange (within the same network) is matched by specific fields such as dialled digits, inlet source, identity of exchange outlet and regrouped into a complete record consisting of an incoming portion, an outgoing portion and as many intermediate portions as required (depending on the number of intermediate exchanges).

This approach allows accurate forecasting of traffic, especially in toll networks where billing records are available and can be used to reflect precisely traffic trends in subtending networks.

Because it gives detailed description of the treatment given to calls, the call detail records provide valuable information for servicing and maintenance purposes without requiring any assumptions on the routing.

For traffic measurement purposes additional fields can be included in CDRs. However, all traffic measurements cannot, or are not suitable to, be based on CDRs for the following reasons: the information cannot be put to a CDR, the size of a CDR will grow too large if too much information is included in a CDR and finally, processing the CDRs may be too inefficient compared with more direct ways of obtaining the same information.

The following traffic measurements seem to be better made using other ways than processing CDRs:

– measurements of the SS No. 7 network (for instance, the message load);

– measurement of trunk and internal channel loads and trunk blocking;

– measurement of centralized resources such as touch-tone dialling machines, conference circuits and answering machines;

– measurements of active subsystems such as processor loads and traffic counters in service control points in the intelligent network.

# 6 Direct destination measurements

## 6.1 Description

Measurements on origin and destination basis can be made by direct measurement where the measurement object is the destination code, e.g. country code, numbering area code. Direct destination measurement may be performed on each route separately (measurement type 11 in Recommendation E.502) or for all outgoing traffic from an origin switch (measurement type 22 in Recommendation E.502). For each destination code, in addition to carried traffic, the number of bids/seizures resulting in an answer signal should be made. This gives valuable information in the interpreting measurement results and could also be used for network management purposes Answer Seizure Ratio/Answer Bid Ratio (ASR/ABR).

## 6.2 Application

This approach allows direct identification of the corrective actions which are required in the network. Since these measurements are begged for every call, a large sample of data can be analysed for given network topology and traffic conditions.

Because traffic data is typically aggregated on a switch basis, a small volume of data needs to be retained. Although somehow less precise than call detail records, this data can also be accumulated for forecasting.

If collected in near real-time, direct destination measurements can be used for network traffic management, thereby encouraging the use of dynamic routing strategies.

# 7 Measurement principles

All the considerations presented in Recommendation E.500 with respect to circuit group measurements also apply to destination-based measurements.

# 8 Recommendation history

This is a revision of Recommendation E.491, first published in 1992.

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