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DIGITAL EXCHANGES

DIGITAL EXCHANGE MEASUREMENTS

ITU-T Recommendation Q.544

(Extract from the *Blue Book*)

NOTES

- 1 ITU-T Recommendation Q.544 was published in Fascicle VI.5 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).
- 2 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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Recommendation Q.544

DIGITAL EXCHANGE MEASUREMENTS

1 General

This Recommendation applies to digital local, combined, transit and international exchanges for telephony in Integrated Digital Networks (IDN) and mixed (analogue/digital) networks, and also to local, combined, transit and international exchanges in an Integrated Digital Networks (ISDN). The field of application of this Recommendation is more fully defined in Recommendation Q.500. Some measurements only apply to a certain type (or types) of exchange. Where this occurs, the application is defined in the text. Where no such qualification is made, the measurement applies to all exchange applications.

This Recommendation includes traffic and performance measurements that are necessary for provisioning and operating exchanges so as to satisfy grade of service objectives covered in the E.500 series of Recommendations. These measurements are typically performed during specified periods and intervals after which the results are sent to designated local and/or remote exchange terminals or operation and maintenance centres (OMC) or any other appropriate data handling centre. In some cases, data may be utilized in its original form whereas in other cases data may need to be processed to determine when pre-set thresholds are exceeded and/or to recognize an abnormal condition when it occurs. In this Recommendation, no particular system design requirement is implied. Different designs may have more or less data accumulated and processed within the exchange or by an external system.

Different types and sizes of exchanges may require different sets of measurements. Also, different Administrations may have different requirements for measurements depending on policies, procedures or national network considerations. An Administration may thus find it desirable in some applications to measure items that are not covered by this Recommendation whereas in other applications some measurements may not be desired.

Exchange measurements are required for both national and international service. Requirements for international service take into consideration the following CCITT Recommendations:

- Recommendations E.401 to E.427: International telephone network management and checking of service quality;
- Recommendations E.230 to E.277: Operational provisions relating to charging and accounting in the international telephone service.

The aspects of traffic engineering are given in Recommendations E.500 to E.543. Recommendations on traffic measurements for SPC exchanges are provided by Recommendations E.502, E.503 and E.504.

Additional measurements in an exchange, not specified in this Recommendation, are required, e.g. for:

- Transmission performance (Recommendations Q.551, Q.552, Q.553 and Q.554).
- Digital access signalling (Recommendations Q.920 to Q.931). This is for further study.
- Packet mode (Recommendations X.25 and X.75). This is for further study.
- Signalling System No. 7 (e.g. those measurements specified in Recommendation Q.791 for the message transfer part require further study to determine their applicability to this Recommendation).

Note – For the terms and definitions of teletraffic used in this Recommendation, see Recommendation E.600.

2 Measurement processes

2.1 General

The activities involved in exchange measurements can be split in four processes as represented by Figure 1/Q.544.

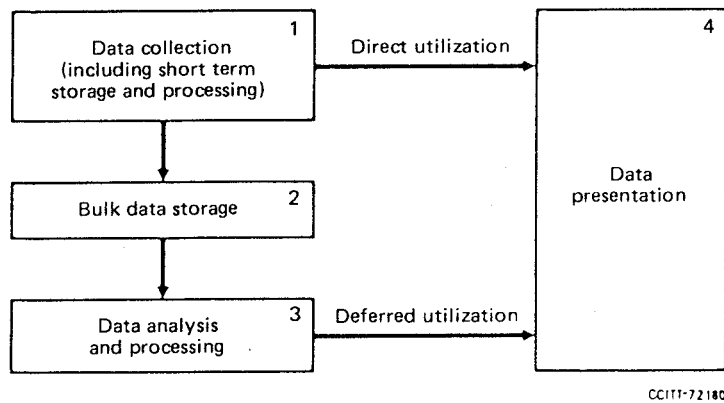


FIGURE 1/Q.544
Measurement processes

On choice of each individual national Administration, the above four processes can be fully or partially integrated into the exchanges.

It is nevertheless recommended that:

- a) *data collection* be fully integrated into the exchange for all types of data;
- b) *data presentation* be integrated into the exchange and/or at the O&M centre at least for the measurements required by O&M personnel.

Presentation of data required for planning and administration activities could be performed at the O&M personnel premises or in other locations which could be more centralized and generally takes place at a deferred time.

2.2 *Data collection*

Three different activities of data collection can be identified:

- event registration;
- traffic registration (traffic intensity and/or volume of traffic);
- call records registration.

The data generated by event registration and traffic registration are suitable for direct utilization (immediate presentation).

Call records can only be utilized after off-line analysis. Processing of call records can generate any type of data, including the event registration and traffic registration.

2.3 *Bulk data storage, analysis and processing*

Data storage for collected data can be required for accumulation of a massive data base suitable for subsequent analysis and processing.

These data can be held in the exchange for processing at the exchange location or transferred to administrative and engineering centres.

2.4 *Data presentation*

It is the function through which the collected data are becoming readable. Features related to the data presentation are:

- a) location of presentation;

- b) time frame of presentation. It is dependent on the nature of the data and their utilization. The activities of maintenance and network management require immediate presentation;
- c) physical support of the displayed data and relevant format. These aspects are mainly related to the type of data and are to be left to individual implementations.

3 Types of measurement data

Measurement data primarily consists of counts of various events and the traffic intensity on various resources. For certain measurement data, sampling, or time averaging techniques may provide an acceptably accurate result. In some cases, externally generated test calls may provide the most practical method of obtaining the data. In other cases, call records, such as detailed charging records, may be used.

3.1 *Event counts*

Events, for example incoming seizures, call attempts encountering busy, and call attempts to specified destination codes should be countable. Some event counts may be accumulated over the whole exchange whereas others may be accumulated only over a subset such as an inter-exchange circuit group. In some cases, event counts may be accumulated several ways.

3.2 *Traffic intensity*

Traffic intensity on a pool of resources is the traffic volume divided by the duration of observation. It is thus equal to the average number of busy resources. As in the case of event counts, traffic intensity data may be for the whole exchange or for various subsets.

3.3 *Call records*

Call records contain data used by the exchange for the setting up of calls. The data may include the identity and classification of the originating line or incoming circuit, the dialled number, the call routing and disposition, and possibly the time of occurrence of certain events during the entire call period.

Call records can be generated and outputted by the exchange to allow the establishment of a data base suitable for off-line processing to determine traffic values and characteristics. Output of the call records associated with a statistical sample of total calls may be sufficient for this purpose.

4 Measurement administration

Exchanges should provide capabilities for operating personnel to establish measurement schedules and direct the output routing of measurement results. The methods of establishing measurement schedules should be designed to minimize the introduction of errors when defining relevant parameters. It should be possible to have a number of measurements simultaneously active with different schedules and output routings. A single measurement should be capable of having more than one measurement schedule and/or output routing simultaneously. The number of measurement types running concurrently may be limited to conserve exchange storage and processing resources. Criteria for measurement and recording of traffic may be found in Recommendation E.500 and other related E-Series Recommendations.

4.1 *Scheduling*

4.1.1 *Recording periods*

A recording period is the time interval during which a measurement is performed. Measurements can be activated either on-demand or according to a time schedule.

Different measurement periods may be schedulable for different days of the week. For example, a measurement may be scheduled for 0900 to 1800 on Monday through Friday and 0900 to 1200 on Saturday. The measurements for an entire week may be programmed and the weekly cycle may be repeated until a new command will stop it.

4.1.2 *Result accumulation periods*

A recording period contains one or more result accumulation periods. The beginning and ending of the recording period must correspond to the beginning and ending of result accumulation periods.

The measurement result outputs are to be made available at the end of each result accumulation period and shall refer to that period.

More than one result accumulation period may be required for an individual measurement.

4.2 *Data output criteria*

4.2.1 *On schedule*

Measurement data output typically occurs shortly after the end of each result accumulation period specified by the measurement schedule. Alternatively, the exchange may store the data in its memory for limited periods, e.g. in the event of contention for output resources.

4.2.2 *On demand*

(For further study.)

4.2.3 *On exception*

The exchange should be able to provide measurement data when specified criteria are met, for example, when the rate of incoming call attempts exceeds a particular value.

4.3 *Data output routing*

4.3.1 *To a local or remote terminal*

Measurement data should be able to be routed for printing or display on designated terminals which are either directly connected to the exchange or remotely connected via dedicated or switched circuits.

4.3.2 *To an external processing centre*

Measurement data should be routable to external locations such as OMC that provide data collection and analysis functions for multiple exchanges.

4.3.3 *To local storage media*

An Administration may require exchanges to store measurement data in bulk memories such as magnetic tapes for later processing and analysis. This could be an alternative to sending the data to an OMC.

4.4 *Priorities*

High priority should be assigned to certain measurements that are essential, e.g. those associated with collection and output of data used for overload detection, network management and accounting. These should not be discontinued during periods of exchange processing congestion (see Recommendation Q.543, § 3.8). Measurements that have been suspended should be resumed in an order that is reverse to the order in which they were suspended.

When recovery procedures are invoked, records associated with call accounting and billing should be retained.

5 **Application of measurements**

5.1 *Planning and engineering*

Measurement data is essential for planning efficient telecommunication networks that meet specified grade-of-service standards. Analysis of data accumulated over a period of time provides information needed to forecast future demand and to plan and engineer extensions to the network.

5.2 *Operation and maintenance*

Operation and maintenance functions are supported by the following types of measurement data: