ANNEX B

(to Recommendation Q.543)

AN EXAMPLE OF A METHODOLOGY FOR MEASURING EXCHANGE CAPACITY

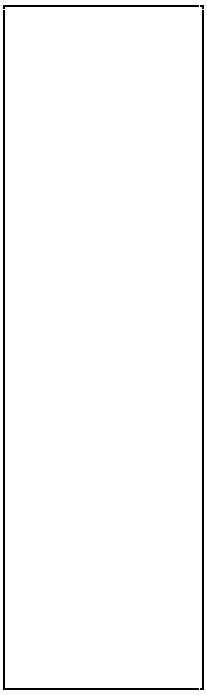
B.1 *General*

The capacity of an exchange used for call processing can be measured in a laboratory or in the field and projections can be made to predict the maximum processing capacity of the exchange design for the configuration and load characteristics involved in the measurements. This Annex serves as an example of a methodology that makes it possible to measure the processing capacity of an exchange for the configuration and load characteristics involved in the measurement.

B.2 *Theory behind the measurement method*

The call handling capacity of *a processor* can be expressed in terms of the maximum number of calls (or call attempts) which can be processed in a fixed interval of time while meeting all service criteria. In normal conditions, the work functions performed by a switching system processor can be divided into three categories (one fixed level and two variable) as shown in Figure B—1/Q.543.

Figure B—1/Q.543 - T1102850-86



At normal loads, a linear relationship is usually observed between offered load and processor utilization. However, at heavy loads, some system components may become overloaded and this can be reflected in non—linearity in the processor utilization versus load characteristic.

In the case of a single processor controlled system, Figure B—1/Q.543 represents the processing capacity of the exchange. In a multi—processor system, the capacity is distributed among processors and the exchange capacity is related to the system configuration and the exchange processing capacity is a function of the processors involved in call handling functions.

As shown in Figure B—1/Q.543, the processing capacity of a processor is divided between three elements:

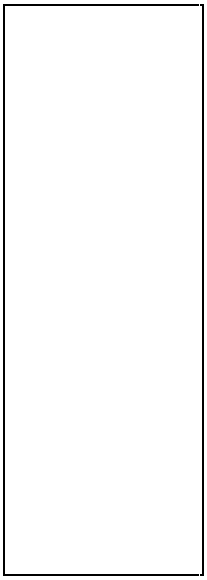
1) fixed overhead related to mandatory tasks (e.g. task scheduling and scanning);

2) call processing work (including traffic—related overhead tasks);

3) deferrable (base—level) tasks (e.g. routine maintenance).

The tasks which a processor executes are assigned to three levels of priorities, base, medium and high—level tasks (see Figure B—2/Q.543 a) and Figure B—2/Q.543 b)).

Figure B—2/Q.543 - T1102860-86



As the traffic load (call attempts) increases call processing work expands and the processing of deferrable tasks decreases.

Measurement of the percentage of time spent by the processor performing base—level tasks gives an indication of the percent or processing capacity required for a particular load on the processor.

As shown in Figure B—2/Q.543 a), at low traffic load, the percentage of time used to perform base—level tasks is relatively high. In Figure B—2/Q.543 b), at high traffic load, the percentage of time at base—level is relatively low. Thus the measurement of percentage of time used to perform base—level tasks can be used to determine call processing capacity.

B.3 *Capacity measurement methodology for exchanges*

Measurements can be performed on exchanges in laboratories or in the field to measure capacity usage for various load levels and then to project the data to estimate the call processing capacity of a processor.

The collection of data will depend on facilities available to perform the required measurements. The exchange may be designed to provide indications of time spent performing base—level tasks or it may be necessary to access the bus system of a processor in order to measure this time. Equipment will be needed to create loads, or loads in a working exchange must be measured in order to establish load points. Various level loads for the various types of calls (or services) should be observed in order to establish a basis for projecting the load line to determine the maximum processing capacity for the mix of traffic services assumed or measured. In projecting call capacity care must be taken not to extrapolate beyond the linear region of the processor utilization versus offered call attempts relationship.

Where multi—processors are involved, the exchange configuration, the distribution of traffic types and processing capacity of each processor must be examined to determine the limiting factors that controls the exchange capacity (as discussed in Annex A. An example of methodology for computing the call processing capacity of a digital exchange, taking into account ISDN services, including packet data handling).

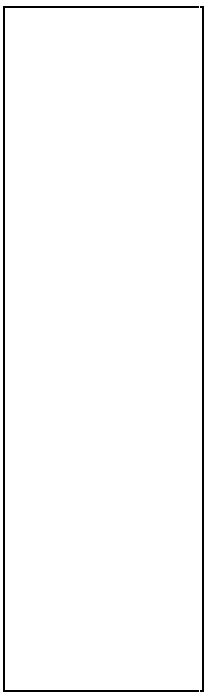



Figure B—3/Q.543 - T1102871-89