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

Operation, numbering, routing and mobile service – Utilization of the international telephone network for non-telephony applications – General

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IMPACT OF NON-VOICE APPLICATIONS ON THE TELEPHONE NETWORK

Reedition of CCITT Recommendation E.301 published in the Blue Book, Fascicle II.2 (1988)

NOTES

1 CCITT Recommendation E.301 was published in Fascicle II.2 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.

Recommandation E.301

IMPACT OF NON-VOICE APPLICATIONS ON THE TELEPHONE NETWORK

1 Introduction

The present telephone network is capable of providing a bearer service for a range of non-voice service applications. These include:

– data (analogue coded),

– facsimile,

– phototelegraphy,

– VF telegraphy.

VF telegraphy is not carried on the public switched telephone network (PSTN). Furthermore, phototelegraphy calls use telephone circuits removed from normal service, as set out in Recommendation E.320. For calls on the PSTN therefore, only data and facsimile services are considered below.

Special considerations may need to be given to the suitability of the telephone network to carry these services because of their particular characteristics which differ from those of voice traffic in the following ways:

a) the transmission of these services is characterized by a continuous power loading, compared to the syllabic bursts found in speech;

b) non-voice traffic often has a 24-hour traffic profile different from voice traffic, but similar to other non-voice services such as telex;

c) call holding times are often significantly shorter than voice traffic.

While ISDN will be based on the concepts developed for the telephone network and may evolve by progressively incorporating additional functions and network features, the transition from existing networks to comprehensive ISDNs may require a period of time. On the understanding that non-voice application on the present telephone network demonstrates the provision of pre-ISDN bearer services, this Recommendation provides an analysis of some of the problems which may be encountered in the existing telephone network during the PSTN to ISDN transition period and suggests a number of solutions for these problems.

2 Signalling and transmission considerations

2.1 *Signalling*

Non-voice service signals can interfere with telephone circuit signalling systems and vice versa.

Data or facsimile signals can interfere with signalling systems which use in-band line signalling such as Signalling Systems No. 4, No. 5 and R1. Thus such non-voice calls should use the standardized systems set out in the Series V and T Recommendations since these are designed to prevent interference with the standard signalling systems, either by avoiding the particular signalling frequencies or by operating the guard circuit of the signalling receiver.

Despite the safeguards mentioned above, it may sometimes happen that the signalling receiver is momentarily operated by the carried service signal. In this case the splitting device in the signalling receiver will operate and cause a short discontinuity in the received service signal.

2.2 *Transmission*

2.2.1 *Interference to transmission systems*

If the proportion of non-voice calls is large, it can increase the overall power loading in a transmission assembly (group or supergroup). This can cause distortion in the group of signals and/or the operation of power limiters which can adversely affect other calls or services in the same transmission assembly.

In order to economize on the provision of international voice channels, some international transmission systems may be fitted with speech interpolation systems, such as TASI (time assignments speech interpolation). Circuit gains are realized by exploiting the silent period normally existing during speech conversations. Continuous non-voice service signals will cause the continuous operation of the speech detectors and give rise to permanent association of the telephone circuit to the transmission channel. This in turn increases the probability of noticeable speech clipping and in severe cases the occurrence of freeze-out where no channel is available. Thus the quality of speech on parallel voice calls can be affected, resulting in a need to reduce the gain advantage of the speech interpolation system.

Information on speech interpolation systems can be found in Supplement No. 2 of Fascicle VI.1.

2.2.2 *Interference by transmission systems*

It may be the case that ordinary speech channels do not provide an adequate transmission path for some types of non-voice service, resulting in an unacceptable error performance, or in the worst case not allowing any service at all.

Echo suppressors will not allow the transmission of duplex data unless the tone-disabling signal is first applied and immediately followed by the service signal.

Some types of transmission systems do not support higher speed data transmission. In particular, adaptive differential pulse code modulation (ADPCM) specified in Recommendation G.721 uses a 32 kbit/s coding technique for the speech channel and may not support higher data speeds, e.g. 9600 bit/s.

2.3 *Potential solutions*

If the transmission of non-voice services on the telephone network is found to cause problems due to the above issue, the Administrations concerned should take the following actions:

2.3.1 It should be established for each bilateral relationship what commercial and regulatory arrangements exist which recognize the need to provide for non-voice services within prescribed quality of service parameters.

2.3.2 If it is decided by the Administrations concerned that certain services must be supported, then two approaches can be taken:

a) only transmission systems allowing reliable performance for non-voice services are used;

b) separate routings are established for the whole or part of the networks, where unreliable transmission would otherwise occur.

2.3.3 In case b) above, it is necessary to know when subscribers are initiating non-voice calls. There are three methods for achieving this:

i) the subscriber line is known to be one originating only non-voice calls, e.g. it is a facsimile terminal;

ii) the subscriber sends some form of service indication to the network, identifying a non-voice call request (e.g. Recommendation E.131);

iii) the subscriber dials or selects a particular prefix before the international (or national) number requesting a non-voice service call.

If these indications are directly available at the exchange where the separate routing is selected, then path selection need only combine this indication with the dialled digits. In other cases it is necessary for a suitable signalling system to be employed to carry this indication forward to the special selection point. This may be done using signalling systems including special call categories. In particular, a call category “data call” is provided in Signalling Systems R2, No. 6 and No. 7, also No. 5 by bilateral agreement. The separate routing may be continued throughout the network using either “path of entry” indications at the exchanges concerned or the special call category signals within the signalling system. Such special arrangements for non-voice calls may have an impact on charging rates.

3 Traffic profiles

On international routes the peaks of voice and non-voice traffic may occur at different times due to, for example, different time zones. Some typical traffic profiles are described in Annex A. This difference has implications when calculating the gain of speech interpolation systems such as TASI and DSI (digital speech interpolation). The gain is basically the ratio of the number of telephone circuits, 8those connected with the telephone switching system), to the number of bearer circuits (those connected to the transmission facilities).

The number of required telephone circuits is designed to meet the busy-hour traffic volume, and the number of required bearer circuits is calculated from the total number of circuits required for voice and non-voice traffic. As a result, there is a possibility that the peak time of required telephone circuits and bearer circuits may appear at different hours.

Therefore the number of required telephone circuits with speech interpolation systems and bearer circuits needs to be dimensioned considering the 24-hour traffic profiles of both voice and non-voice.

4 Special provisions for end-to-end digital connectivity

4.1 Within IDNs it is possible to transport data on an end-to-end basis using the digital bit stream rather than analogue modulated signals. When ISDN features are implemented, the requirements of both voice and non-voice services will be met. Interim arrangements may exist before the ISDN however, that allow the provision of end-to-end digital connectivity for transmission of digital data.

Compared to the call set-up principles for voice calls, the following arrangements need to be applied:

i) only compatible digital circuits must be selected, e.g. all circuits use transparent 64 kbit/s transmission;

ii) all digital speech processing (DSI) systems (e.g., CME, DSI, ADPCM) must be disabled or bypassed in the data transmission phase;

iii) any μ-law to A-law convertors must be disabled or bypassed in the data transmission phase;

iv) all echo suppressors or cancellors must be disabled or bypassed in the data transmission phase;

v) digital transmission attenuation pads must not be used;

vi) network and access signalling may be either in-band or out-of-band;

vii) Recommendation E.164 numbering plan[1)] applies.

4.2 Details for these arrangements are for further study. In order that these arrangements may be provided from the originating network to the destination network, the signalling system applied should have the capability to convey such non-voice service requests; for example, in the case of TUP of the Signalling System No. 7, at least such as additional function must be implemented among Administrations concerned in order to convey the customer request for “unrestricted bearer capability” to the transit and destination networks. It should be also noted that terminal compatibility cannot be negotiated between the originating terminal and destination terminal within the capability of TUP. In this case, therefore, the subscriber can only communicate with the destination number which, he knows in advance, is accommodating a compatible non-voice terminal.

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1) Recommendation E.164 encompasses E.163.

ANNEX A

(to Recommendation E.301)

Teletraffic characteristics of non-voice traffic

A.1 *Mean call duration*

There can be a significant difference in call duration between voice and non-voice traffic. For example, the mean call duration of non-voice traffic is three minutes in most cases, while the average call holding time for voice traffic can range between 6-9 minutes.

A.2 *24-hour traffic profile*

The 24-hour non-voice traffic profiles measured are in general alignment with business activities. The traffic peak appears at the end of office hours in the originating country, which is similar to the profiles of telex and record-type telecommunication services in non-attended mode of operation. The calculated profiles according to the hour(s) of time difference (i.e., $r = 0, 1, 2, \ldots, 12$) are shown in Figure A-1/E.301, together with the examples of measured 24-hour profile of the mixed voice and non-voice traffic in Figure A-2/E.301. In cases where the countries have a significant time difference, the both-way traffic (sum of outgoing and incoming traffic) has two traffic peaks, corresponding to the end of the business hours in each country.

Voice communication is only possible when calling and called parties are present at both ends and therefore, generally align with the schedule of human activities. Thus, peak hours of voice and non-voice traffic may differ. In Figure A-2/E.301, countries A and B have similar peak hours for both traffic streams while country C has two peaks, one (earlier) for voice and the other for non-voice. This can contribute to flattening the traffic profile thus making more efficient use of the circuit group. It should also be noted that non-voice traffic may sharpen the peak of the profile in case of short overlapping of business hours between two countries. This may affect the dimensioning of the network and require additional circuits to cover only a short period of time.

It is therefore important that countries measure and understand the traffic on their routes so that efficient dimensioning of the network can be undertaken.

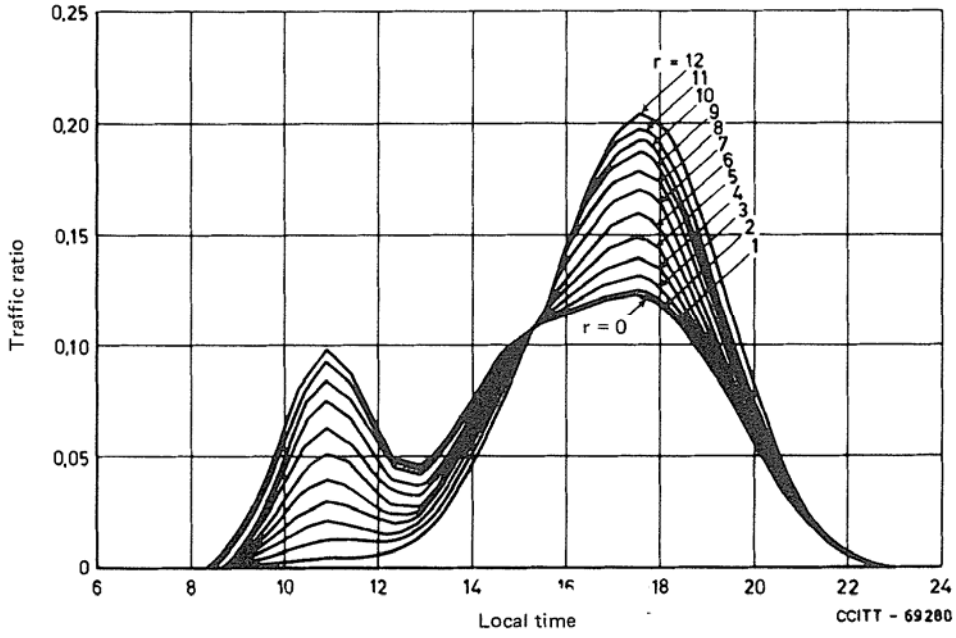
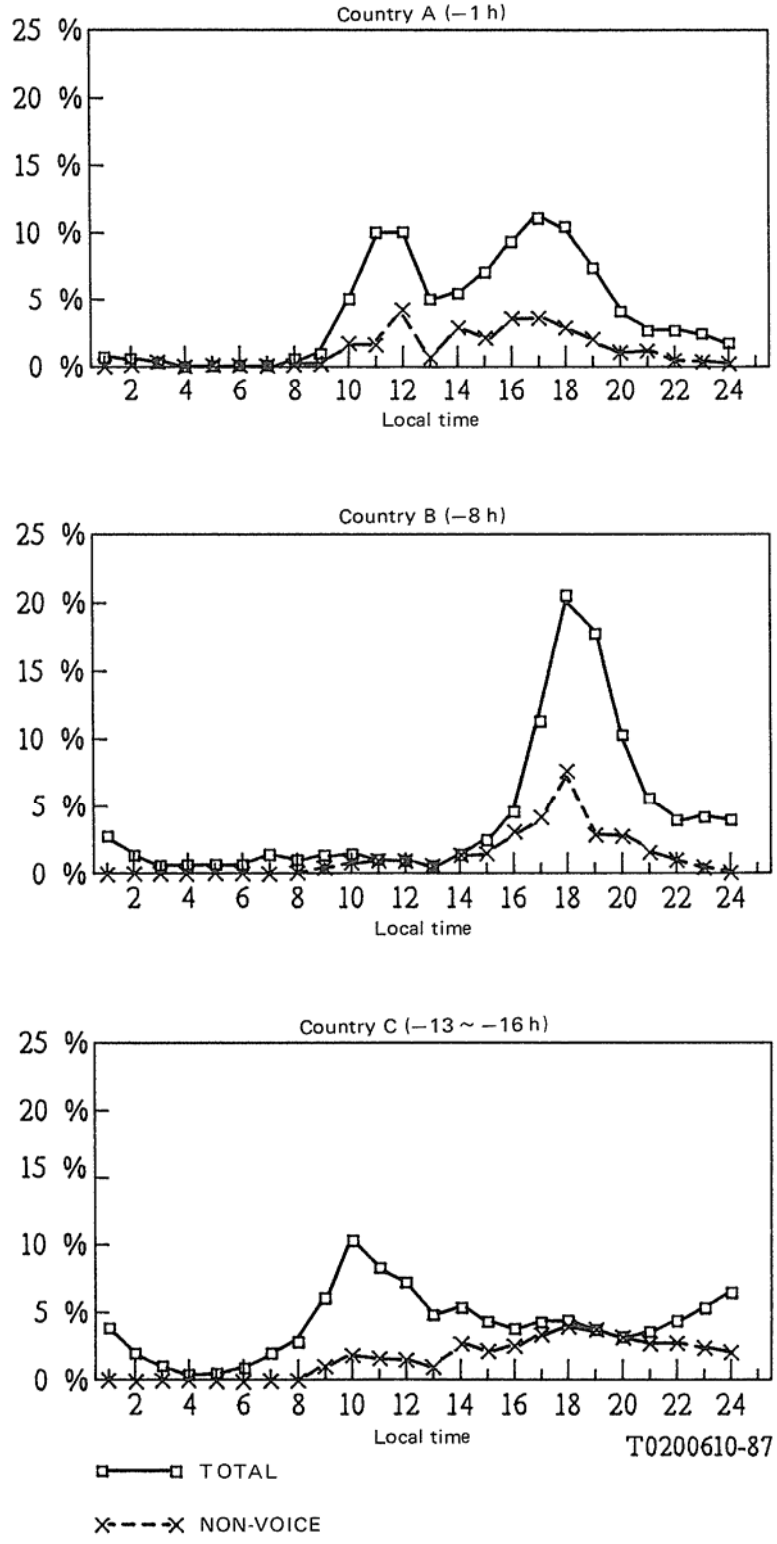


Figure A-1/E.301

24-hour traffic profile for telex and record-type telecommunication services (calculated)



Note 1 – The figure shows outgoing traffic from the reference country.

Note 2 – The figure shows traffic volume expressed by concentration ratio.

Figure A-2/E.301

24-hour distribution of total telephone traffic and non-voice traffic contained in it (measured)

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