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**TELEPHONE NETWORK AND ISDN
OPERATION, NUMBERING, ROUTING
AND MOBILE SERVICE**

**IMPACT OF NON-VOICE APPLICATIONS
ON THE TELEPHONE NETWORK**

ITU-T Recommendation E.301

(Previously "CCITT Recommendation")

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The 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 Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation E.301 was revised by the ITU-T Study Group II (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

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 E.301**IMPACT OF NON-VOICE APPLICATIONS
ON THE TELEPHONE NETWORK***(Modified at Helsinki, 1993)***1 Introduction***recognizing*

that true Integrated Service Digital Networks (ISDNs) as described in the I-Series Recommendations, will evolve from Public Switched Telephone Networks (PSTNs);

that this evolutionary process is already well under way in that digital capabilities are being introduced in PSTNs all over the world, in place of analogue facilities;

that although the realization of true ISDNs worldwide is unlikely to occur for many years, the introduction of digital capabilities nevertheless provides the opportunity for Administrations to improve the quality of existing services and simultaneously also offer new "ISDN-like" services; and

that these same digital capabilities may also introduce network elements that may adversely impact service quality in ways not yet fully understood;

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. Further, this Recommendation also described network control and routing procedures that can be used to provide high levels of service quality for all services until a comprehensive ISDN can be achieved.

2 Scope

From a network capabilities point of view, it is convenient to separate the various types of traffic that PSTNs may be expected to carry into the following two broad categories.

Category 1 applications are those traffic streams that can be carried over analogue networks but will henceforth be carried on digital facilities in order to realize the quality improvements inherent in digital transmission. Examples of such applications include data and facsimile with further details contained in section 4.

Category 2 applications are primarily those traffic streams that inherently require digital facilities and in addition may require further network actions to accommodate requirements peculiar to the particular traffic stream. Examples of such applications include switched digital services with fuller details given in clause 7. However, there may be cases where an Administration may choose to treat an application normally considered to be of Category 1 as a Category 2 application. For example, an Administration providing switched transit service may choose to provide special treatment to transit calls.

Within this framework, the scope of this Recommendation is as follows:

This Recommendation only deals with PSTNs which are evolving, by the introduction of digital capabilities, towards ISDNs.

Clauses 4, 5 and 6 deal with Category 1 applications. Clauses 7, 8 and 9 deal with Category 2 applications.

CSPDNs and PSPDNs, which are based on the X.121 numbering plan, and the interworking between these networks and PSTNs is outside the scope of this Recommendation.

Finally, it should be noted that this Recommendation does not consider Packet Circuit Multiplication Equipment (PCME) technology. The impact of this technology on the issues discussed here are for further study.

3 Related Recommendations

The following Recommendations cover related topics in the evolution of PSTNs towards ISDN:

- Rec. E.164 *Numbering plan for the ISDN era*;
- Rec. E.171 *International telephone routing plan*;
- Rec. E.172 *ISDN routing plan*;
- Rec. G.721 *32 kbit/s Adaptive Differential Pulse Code Modulation (ADPCM)*;
- Rec. G.726 *Adaptive pulse code modulation for 40, 32, 24, 16 kbit/s(ADPCM)*;
- Rec. G.727 *5-, 4-, 3-, 2- bits sample, embedded ADPCM*;
- Rec. G.728 *16 kbit/s low-delay CELP (LD-CELP) speech coding algorithm*;
- Rec. G.763 *Digital circuit multiplication equipment using 32 kbit/s ADPCM and digital speech interpolation*;
- Rec. G.766 *Facsimile demodulation and remodulation in DCME*;
- Rec. P.84 *Subjective listening test method for evaluating digital circuit multiplication and packetized voice systems*.

4 Category 1 applications

In this clause we consider three types of Category 1 applications classified as the following.

4.1 Voice

Voice traffic is mainly composed of speech conversation. Because of the rapid deployment of Digital Circuit Multiplication Equipment (DCME) which utilizes speech interpolation and compression to efficiently utilize digital facilities, increasing volumes of non-voice traffic can cause problems that can affect the performance of voice traffic.

4.2 Non-voice

Voice-band traffic which is not speech. Example applications for which the present telephone network is capable of providing bearer services include:

- data (analogue coded);
- facsimile;
- scrambled speech;
- phototelegraphy;
- Voice Frequency (VF) telegraphy.

VF telegraphy is not widely carried on PSTNs. Furthermore, phototelegraphy calls use telephone circuits removed from normal service, as set out in Recommendation E.320. Therefore, for calls on the PSTN, only Voice-Band Data (VBD) and facsimile services are considered below.

Between these two non-voice applications, probably the most common type is facsimile. In fact, for certain traffic streams the majority of the traffic is facsimile. At the same time facsimile traffic is growing at several times the rate of voice traffic.

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 some 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; this is especially true for international routes, where time zone differences result in the peaks of voice and non-voice traffic occurring at different times (see Annex A for some typical traffic profiles);
- c) mean call holding times are often significantly shorter than voice traffic.

4.3 Mixed

Traffic which has both voice and non-voice transmission. An example of one such service would be videotelephony.

5 Signalling and transmission considerations for Category 1 applications

The increasing presence of non-voice traffic in Category 1 applications may result in signalling and transmission problems.

5.1 Signal interference

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.

5.2 Transmission

5.2.1 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.

5.2.2 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.

For example, echo suppressors may 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. For example, the 32 kbit/s ADPCM algorithm in Recommendation G.726 supports VBD traffic only up to 4800 bit/s and the 40 kbit/s algorithm in G.726 supports VBD rates up to 9600 bit/s with 14 400 bit/s supported only for non-tandem connections. Also the LD-CELP algorithm in G.728 supports VBD only up to 2400 bit/s.

5.3 Potential solutions

If the transmission of non-voice services on the telephone network is found to cause problems due to the issues discussed in 5.2.1 and 5.2.2, the Administrations concerned should take the following actions: