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SERIES V: DATA COMMUNICATION OVER THE
TELEPHONE NETWORK

Interworking with other networks

**Procedures for establishing communication
between two multiprotocol audiovisual
terminals using digital channels at a multiple of
64 or 56 kbit/s**

ITU-T Recommendation V.140



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ITU-T Recommendation V.140

Procedures for establishing communication between two multiprotocol audiovisual terminals using digital channels at a multiple of 64 or 56 kbit/s

Summary

This Recommendation describes a standardized method for automatic mode negotiation, detection of bit alignment, and confirmation of subchannel connectivity for multimedia terminals on digital networks. This new protocol provides backward compatibility with existing standards and creates an extensible mechanism to negotiate future protocols.

The two primary benefits from implementing this Recommendation are:

- 1) improved reliability in completing calls and successfully establishing multimedia communications, since peculiar network characteristics (such as "restricted" networks) that interfere with call establishment and protocol negotiations are automatically handled by V.140 procedures; and
- 2) for terminals that support multiple communication modes, an automatic means of selecting modes.

Principal features of this Recommendation include the ability to find bit alignment, detect remote network type, and perform in-band testing of channel characteristics; a flexible and extensible capability exchange and mode selection facility is also built-in.

V.140 procedures apply to every channel of a multi-channel call and begin following establishment of the end-to-end digital connection, and before any multimedia or other communication protocols are initiated. The procedures are divided into three phases:

- Phase 1 – Send/search for V.140 signature (note that V.8/V.8 *bis*, voice, and H.221 FAS, or any subset of these may be simultaneously transmitted). If such signature is detected, proceed to:
- Phase 2 – Characterize the digital connection (64 vs 56 kbit/s, detect octet/septet alignment), and diagnose any odd characteristics of the network, (i.e., it could be restricted, that is, it transfers only 7 of 8 bits to the far-end). Once this is complete,
- Phase 3 – Exchange mode capabilities (similar to V.8 *bis*) and select desired operation mode. Modes can include voice communications, multimedia communications, and channel aggregation protocols, but capabilities are kept simple, given that the purpose of this Recommendation is only to select a particular protocol, not to determine all of the parameters related to that protocol (which can typically be determined using the protocol itself).

The Phase 1 procedures have been designed to allow simultaneously signalling of other protocols, such as H.320, to minimize the amount of time lost in beginning communications if a terminal that implements V.140 finds itself communicating with a terminal that does not.

Following Phase 3, a terminal can immediately begin procedures associated with the selected operation mode.

This revised version incorporates corrections to errors noted between the original approval in February 1998 until November 2004. In particular, the bit order illustrated in Figure 11 has been corrected to match the body text, and in Annex A incomplete ASN.1 syntax has been restored and references to multilink operation according to Annex F/H.324 have been added.

Source

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FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

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As of the date of approval of this Recommendation, ITU 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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ITU-T Recommendation V.140

Procedures for establishing communication between two multiprotocol audiovisual terminals using digital channels at a multiple of 64 or 56 kbit/s

1 Introduction and scope

This Recommendation defines automatic mode negotiation and selection for multiprotocol audiovisual terminals connected to digital networks such as the ISDN. The procedures in this Recommendation are intended to avoid interference with those of pre-existing Recommendations.

The procedures in this Recommendation automatically determine network connectivity and bit alignment between terminals. Also, they enable prompt and accurate negotiation of a common mode of operation when one or both terminals support multiple protocols for audiovisual communication. For example, a terminal might support H.320, H.324 over voiceband modem, and H.323 over ISDN; in this case, the procedures in this Recommendation would be used to negotiate a common protocol, e.g., H.323. Once a mode is selected, further negotiations as recommended for that mode may use information derived from V.140 negotiations, if applicable.

V.140 procedures can also be used to provide an optional initial voice telephony mode before proceeding to multimedia telephony, and to switch from one multimedia telephony mode to another, or back into voice telephony mode.

The means by which digital channels are established between terminals are outside the scope of this Recommendation (see ITU-T Rec. H.200/AV.420). Information regarding the nature of the endpoint terminals available from D-channel signalling may be useful in further accelerating V.140 negotiations; use of such information is for further study.

The procedures of this Recommendation concern only the flow of signals along the fixed digital paths used for the transport of audiovisual content during the call, at integer multiples of 64 kbit/s (or 56 kbit/s in certain networks).

2 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; 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. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- ITU-T Recommendation G.711 (1988), *Pulse code modulation (PCM) of voice frequencies*.
- ITU-T Recommendation H.221 (2004), *Frame structure for a 64 to 1920 kbit/s channel in audiovisual teleservices*.
- ITU-T Recommendation H.242 (2004), *System for establishing communication between audiovisual terminals using digital channels up to 2 Mbit/s*.
- ITU-T Recommendation H.320 (2004), *Narrow-band visual telephone systems and terminal equipment*.
- ITU-T Recommendation H.324 (2002), *Terminal for low bit-rate multimedia communication*.

- ITU-T Recommendation V.8 (2000), *Procedures for starting sessions of data transmission over the public switched telephone network*.
- ITU-T Recommendation V.8 bis (2000), *Procedures for the identification and selection of common modes of operation between data circuit-terminating equipments (DCEs) and between data terminal equipments (DTEs) over the general switched telephone network and on leased point-to-point telephone-type circuits*.
- ITU-T Recommendation X.680 (2002) | ISO/IEC 8824-1:2002, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation*.
- ITU-T Recommendation X.691 (2002) | ISO/IEC 8825-2:2002, *Information technology – ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)*.
- ISO/IEC 3309:1993, *Information technology – Telecommunications and information exchange between systems – High-level data link control (HDLC) procedures – Frame structure*.
- ISO/IEC 13871:1995, *Information technology – Telecommunications and information exchange between systems – Private telecommunications networks – Digital channel aggregation*.

3 Definitions

This Recommendation defines the following terms:

- 3.1 56C interface:** A 56 kbit/s network interface which transfers all bits to the far-end.
- 3.2 64C interface:** A 64 kbit/s network interface which transfers all bits to the network.
- 3.3 64R interface:** A 64 kbit/s network interface which transfers 7 of each 8 bits to the far-end, for a net throughput of 56 kbit/s.
- 3.4 acquire:** To detect a signal a sufficient number of times to meet the specified acquisition criteria.
- 3.5 aligned channel:** A channel for which network byte timing is available to the terminal. Ordinarily, an aligned channel is needed to transport unframed G.711 voice telephony. Network interfaces which do not pass network byte timing, such as V.35 interfaces, cause the terminal to operate as if connected to a non-aligned channel.
- 3.6 byte:** A septet for networks with either a 56C or 64R interface. Also, an octet for networks with a 64C interface.
- 3.7 detect:** To receive a given signal a single time.
- 3.8 octet:** A group of 8 bits. For Phases 1 and 2, if on an aligned channel, each new octet begins at the time specified by network timing.
- 3.9 protocol data unit (PDU):** An HDLC frame carrying a Phase 3 message.
- 3.10 public switched data service network (PSDSN):** A 56 kbit/s public switched data service network, for example the "Switched-56" network in the United States as specified by TIA/EIA-596. Such a network may be sensitive to emulation of escape codes by data entering the network via a 64C interface.
- 3.11 restricted channel:** A channel carried on a network whose B-channels are effectively restricted to 56 kbit/s, or whose channels at H_0 or higher are restricted by ones-density considerations. This can be because the terminal is on a 56C interface or a 64R interface or because of the nature of the network.

3.12 round-trip: Given two terminals, A and B, connected via an ISDN, a round-trip is the transmission via the ISDN of a message from terminal A to terminal B and then from terminal B to terminal A; it is generally assumed that the time required to process and otherwise manipulate the message is negligible compared to the time required for transmission and propagation.

3.13 reflected signature pattern (RSP): A bit pattern transmitted during Phase 2 that is computed from the bit pattern in a particular subchannel as received from a remote terminal. RSP is transmitted in the same subchannel in which it is received to signal the alignment of subchannels received at the terminal.

3.14 septet: A group of 7 bits. If on an aligned channel, each new septet begins at the time specified by network timing.

3.15 signature pattern (SP): A bit pattern transmitted within an individual subchannel to signal the presence of V.140 support and to permit determination of subchannel alignment and continuity.

3.16 subchannel: The bits in a particular bit position of a sequence of bytes. Bits within a byte are numbered 1, 2, 3, 4, ... in order of decreasing significance. The number of the subchannel is the same as the number of the bit position. For example, the sequence of bits in bit position 4 in successive bytes form the bitstream corresponding to subchannel 4.

3.17 terminal: Any of several types of endpoint devices connected to a digital network, including digital terminal equipment and Multipoint Control Units (MCUs).

4 Abbreviations

This Recommendation uses the following abbreviations:

BC	Bearer Capability
CPF	Compatible Protocol Field
FCS	Frame Check Sequence
GSTN	General Switched Telephone Network
HLC	High-Level Capability
ISDN	Integrated Services Digital Network
PCM	Pulse Code Modulation (per ITU-T Rec. G.711)
PDU	Protocol Data Unit
PSDSN	Public Switched Data Service Network
RSP	Reflected Signature Pattern
SP	Signature Pattern
UDI	Unrestricted Digital Information

5 Conventions

The word "shall" is used in this Recommendation to specify a mandatory requirement.

The word "should" is used in this Recommendation to specify a suggested, but not required, course of action.

The word "may" is used in this Recommendation to specify an optional course of action, without expressing a preference.

References in this Recommendation to specific ASN.1 message structures are presented in **this typeface**.

6 Overview

The procedures involve three phases:

- Phase 1 – Send/search for V.140 signature (note that V.8/V.8 *bis*, voice, and H.221 FAS, or any subset of these may be simultaneously transmitted). If signature is detected, proceed to:
- Phase 2 – Characterize digital connection (64 vs 56 kbit/s, detect octet/septet alignment).
- Phase 3 – Exchange mode capabilities (similar to V.8 *bis*) and select desired operation mode.

Once Phase 3 is complete, the selected mode (H.320, H.324, voice, etc.) is entered and normal call startup proceeds.

Each phase should take little more than one round-trip time to complete, so the complete V.140 procedure should finish in little over 3½ round-trip times. Under typical circumstances (an intracontinental call via a 64 kbit/s clear interface), less than 1 second will be added to call startup.

If no "signature" is detected, this indicates that the far-end does not support V.140. The terminal then falls back to any other non-V.140 protocol supported, such as H.320 (if H.221 FAS is detected) or V.8/V.8 *bis* GSTN modes (if V.8/V.8 *bis* is detected), or voice telephony.

These procedures are designed so that terminals can transition from one phase of V.140 to the next at different times without ill effects: the timing of such transitions does not need to be precisely synchronized between terminals.

6.1 Phase 1 – V.140 signature transmission and acquisition

Phase 1 begins with the establishment of the end-to-end digital connection.

A repeating 80-bit pattern containing the V.140 signature is transmitted. The purpose of the signature is to indicate to the far-end that this terminal implements V.140, and is capable of proceeding to the later phases.

The signature has special characteristics. It is transmitted in the low-order bits of each byte to minimize the disruption of G.711 audio and permit simultaneous 48 kbit/s G.711 audio operation.

These characteristics make it possible for the V.140 terminal to signal its signature while also sending GSTN modem tones and H.320 signals for compatibility with existing GSTN and H.320 ISDN terminals (see 6.5), as well as carrying normal speech telephony without startup delay.

If the V.140 signature is detected in received data, this indicates that the far-end also supports V.140. The terminal then mutes received audio and enters Phase 2.

If, after a time-out, the V.140 signature has not been found, the terminal may proceed to any other non-V.140 protocol it supports. If it was also searching for other protocols while looking for the V.140 signature, it may have already detected the far-end's ability to use these modes, and so has not lost any time starting these protocols.

Otherwise, the terminal can continue the call as a voice telephone call, or can initiate another non-V.140 protocol.

6.2 Phase 2 – Channel characterization

There are a variety of national digital network types and interfaces in use. These include 64 and 56 kbit/s networks, and networks and interfaces which do or do not provide octet (or septet) timing. Even between two terminals with 64 kbit/s ISDN connections with network octet timing, it is possible on some national networks to have an intervening 56 kbit/s link. The nature of the end-to-end digital link, including rate and bit alignment, must be confirmed before the link can be used for multimedia communication.

Upon entering Phase 2, each terminal probes the channel to determine the relative octet (if 64 kbit/s) or septet (if 56 kbit/s) alignment between the terminals. This is accomplished using Signature Patterns (SP) that are transmitted independently in each of the eight bit positions on the line.

The bit position in which each SP appears at the receiver tells the receiver about relative alignment between transmitter and receiver. After the SP is detected, each receiver reflects its received SP back to the transmitter. Each terminal can then determine bit alignment and any network restriction for each direction of transmission.

Once this procedure is complete, the terminals proceed to Phase 3.

6.3 Phase 3 – Capability exchange and mode selection

In Phase 3, the two terminals exchange mode capabilities and select a mode.

Using the entire 64 (or 56) kbit/s bandwidth, each terminal sends an HDLC-framed message containing a simple list of its capabilities (detailed capability exchange is left to the procedures of the selected mode). One terminal, normally the calling terminal, then selects a single mode from the list.

The terminal which would ordinarily choose the mode can instead send a **youChoose** message to the far-end, requiring that the other end decide. This can be useful for situations where the calling terminal does not know the intended purpose of the call.

Once Phase 3 is complete, the terminals go directly to the selected mode.

6.4 Using V.140 to switch among multimedia operation modes

These procedures may be used to switch from one multimedia telephony mode to another, or back into voice telephony mode, by re-starting the Phase 3 procedures after termination of a previous mode.

Also, Phase 1 V.140 procedures may be used in a "late-start" mode, after a period of G.711 voice telephony.

6.5 Interoperability with terminals that do not support V.140

In order to support interoperability with existing terminals that do not support V.140, the Phase 1 V.140 signature has been designed to accommodate simultaneous signalling of other compatible protocols. The procedures given below specify how to use the facilities in V.140 to promote interoperability with particular protocols.

A terminal that is attached to an aligned channel and supports G.711 audio:

- shall transmit G.711 audio truncated to 6 bits during Phase 1 (see 8.2.1).

A terminal that supports V.140 and H.320:

- should transmit signals for H.320 operation as defined in ITU-T Rec. H.221 during Phase 1 of V.140 (see 8.2.1 and 8.2.2);
- should not respond to any signals defined by H.320 (i.e., should not complete Sequence A) until it fails to detect the V.140 Phase 1 signature from the far-end terminal.

A terminal that supports GSTN modem operation (e.g., as defined in ITU-T Rec. V.34):

- should transmit signals for GSTN modem operation as defined by V.8 or V.8 *bis* during Phase 1 of V.140 (see 8.2.2);
- should not respond to any signals defined by V.8 or V.8 *bis* until it fails to detect the V.140 Phase 1 signature from the far-end terminal.

A terminal that supports ISO/IEC 13871:

- should search for received signals as defined by ISO/IEC 13871 during Phase 1 of V.140 in order to determine if the far-end terminal supports ISO/IEC 13871 but does not support V.140;
- should not respond to any such signals until it fails to detect the V.140 Phase 1 signature from the far-end terminal.

6.6 Interworking with PSDSNs

Experience indicates that when a call is made from a 64 kbit/s ISDN to some Public Switched Data Service Networks (PSDSN), the low-order bit of each ISDN octet is transported without modification from the ISDN to the PSDSN. This bit is often used by PSDSN devices, such as Channel Service Units (CSUs), for in-band signalling of supervisory messages from the network to the CSU. Under some circumstances, bit values of zero in this position activate features of the CSU leading to loopback of the data stream, call termination, or entry of the CSU into a test mode. In the United States, the code values used for supervisory functions are standardized in TIA/EIA-596.

The procedures given in this Recommendation have been designed to avoid emulation of PSDSN supervisory messages. In certain cases, particular octet values are either mandated or forbidden for this reason.

7 Network types

This Recommendation addresses terminals connected to the following types of digital network interfaces:

- 64 kbit/s clear interfaces (64C) and restricted interfaces (64R) – variants of the same interface;
- 56 kbit/s clear interfaces (56C);
- H_0 interfaces (H_0);
- H_{11} interfaces (H_{11});
- H_{12} interfaces (H_{12}).

A terminal cannot determine if a 64 kbit/s interface is 64C or 64R without using these procedures, since the clear or restricted characteristic is a result of a particular network route and may change from one call to the next. In effect, 64R and 64C are variants of the same interface.

The terminal can be connected to only one of the five network types listed at any particular time. The terminal will know which of the five digital network interfaces it is using.

In every case, the terminal implementing these procedures shall have direct access to and control of the network interface. For example, it is acceptable to use a digital terminal adapter as an interface to the network, but not a channel aggregation device based upon the protocol defined by ISO/IEC 13871 that does not also implement the procedures of this Recommendation.

NOTE – The terminal may use these procedures to negotiate the subsequent use of ISO/IEC 13871 and other channel aggregation protocols, but the procedures of this Recommendation must be executed first of all.

Each network type may or may not have byte-timing alignment from the network.

The procedures of this Recommendation shall be used on each digital channel of every call, including digital voice-only calls, as said channel becomes available for use.

64C interfaces transfer all bits to the far-end, at a rate of 64 kbit/s.