

Integrated Services Digital Network

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Abstract- This interface standard was written to provide the minimal set of requirements to provide for satisfactory transmission between the network and the NT, while conforming, wherever possible, with the I-series of International Telecommunications Union—Telecommunications Standardization Sector (ITU-T) Recommendations, and while not compromising the principles of evolution expressed therein. Equipment may be implemented with additional functions and procedures. This standard presents the electrical characteristics of the integrated services digital network (ISDN) basic access signals appearing at the network side of the NT. It also describes the physical interface between the network and the NT. The transport medium of the signal is a single twisted-wire pair that supports full-duplex (i.e., simultaneous two-way) service.

I. INTRODUCTION

Integrated Services Digital Network (ISDN) is comprised of digital telephony and data-transport services offered by regional telephone carriers. ISDN involves the digitization of the telephone network, which permits voice, data, text, graphics, music, video, and other source material to be transmitted over existing telephone wires. The digital link. TE2s connect to the ISDN network through a TA. The ISDN TA can be either a standalone device, it connects to the TA via a standard physical-layer interface. Examples include EIA/TIA-232-C (formerly RS-232-C), V.24, and V.35. Beyond the TE1 and TE2 devices, the next connection point in the ISDN network is the network termination type 1 (NT1) or network termination type 2 (NT2) device. These are typically found in digital private branch exchanges (PBXs) and that performs Layer 2 and 3 protocol functions and concentration services. An NT1/2 device also exists as a single device that combines the functions of an NT1 and an NT2. ISDN specifies a number of reference points that define logical interfaces between functional groups, such as TAs and NT1s. ISDN reference points include the following:

- R—The reference point between non-ISDN equipment and a TA.
- S—The reference point between user terminals and the NT2.
- T—The reference point between NT1 and NT2 devices.

emergence of ISDN represents an effort to standardize subscriber services, user/network interfaces, and network and internetwork capabilities. ISDN applications include high-speed image applications (such as Group IV facsimile), additional telephone lines in homes to serve the telecommuting industry, high-speed file transfer, and videoconferencing. Voice service is also an application for ISDN. This chapter summarizes the underlying technologies and services associated with ISDN.

II. ISDN DEVICES

ISDN devices include terminals, terminal adapters (TAs), network-termination devices, line-termination equipment, and exchange-termination equipment. ISDN terminals come in two types. Specialized ISDN terminals are referred to as terminal equipment type 1 (TE1). Non-ISDN terminals, such as DTE, that predate the ISDN standards are referred to as terminal equipment type 2 (TE2). TE1s connect to the ISDN network through a four-wire, twisted-pair

standalone device or a board inside the TE2. If the TE2 is implemented network-termination devices that connect the four-wire subscriber wiring to the conventional two-wire local loop. In North America, the NT1 is a customer premises equipment (CPE) device. In most other parts of the world, the NT1 is part of the network provided by the carrier. The NT2 is a more complicated device that

- U—The reference point between NT1 devices and line-termination equipment in the carrier network. The U reference point is relevant only in North America, where the NT1 function is not provided by the carrier network

Services

There are two types of services associated with ISDN:

- BRI
- PRI

ISDN BRI Service

The ISDN Basic Rate Interface (BRI) service offers two B channels and one D channel (2B+D). BRI B-channel service operates at 64 kbps and is meant to carry user data; BRI D-channel service operates at

16 kbps and is meant to carry control and signaling information, although it can support user data transmission under certain circumstances. The D channel signaling protocol comprises Layers 1 and 2. The BRI physical layer specification is International Telecommunication Union–Telecommunications Standards Section (ITU-T) (formerly the Consultative Committee for International Telegraph and Telephone [CCITT]) I.430.

ISDN PRI Service

ISDN Primary Rate Interface (PRI) service offers 23 B channels and 1 D channel in North America. This section describes the various ISDN specifications for Layer 1, Layer 2, and Layer 3.

Layer 1

ISDN physical layer (Layer 1) frame formats differ depending on whether the frame is outbound (from terminal to network) or inbound (from network to terminal). The frames are 48 bits long, of which 36 bits represent data. The bits of an ISDN physical layer frame are used as follows:

- F—Provides synchronization
- L—Adjusts the average bit value
- E—Ensures contention resolution when several terminals on a passive bus contend for a channel
- A—Activates devices
- S—Is unassigned
- B1, B2, and D—Handle user data

Layer 2

Layer 2 of the ISDN signaling protocol is Link Access Procedure, D channel (LAPD). LAPD is similar to High-Level Data Link Control (HDLC) and Link Access Procedure, Balanced (LAPB). As the expansion of the LAPD acronym indicates, this layer is used across the D channel to ensure that control and signaling information flows and is received properly. The LAPD frame format is very similar to that of HDLC; like HDLC, LAPD uses supervisory, information, and unnumbered frames. The LAPD protocol is formally specified in ITU-T Q.920 and ITU-T Q.921.

Layer 3

Two Layer 3 specifications are used for ISDN signaling: ITU-T (formerly CCITT) I.450 (also known as ITU-T Q.930) and ITU-T I.451 (also known as ITU-T Q.931). Together, these protocols support user-to-user, circuit-switched, and packet-switched connections. A variety of call-establishment, call-termination, information, and miscellaneous messages are specified, including SETUP, CONNECT, RELEASE, USER

through 3 of the OSI reference model. BRI also provides for framing control and other overhead, bringing its total bit rate to 192 kbps. The

and Japan, yielding a total bit rate of 1.544 Mbps (the PRI D channel runs at 64 kbps). ISDN PRI in Europe, Australia, and other parts of the world provides 30 B channels plus one 64-kbps D channel and a total interface rate of 2.048 Mbps. The PRI physical layer specification is ITU-T I.431.

ISDN Specifications

INFORMATION, CANCEL, STATUS, and DISCONNECT. These messages are functionally similar to those provided by the X.25 protocol from ITU-T I.451, shows the typical stages of an ISDN circuit-switched call.

III. CONCLUSION

ISDN is comprised of digital telephony and data-transport services offered by regional telephone carriers. ISDN involves the digitization of the telephone network to transmit voice, data, text, graphics, music, video, and other source material over existing telephone wires. ISDN devices include the following:

- Terminal adapters (TAs)
- Network-termination devices
- Line-termination equipment
- Exchange-termination equipment

ISDN uses the following two types of services:

- Basic Rate Interface (BRI), which offers two B channels and one D channel (2B+D)
- Primary Rate Interface (PRI), which offers 23 B channels and 1 D channel in North America and Japan, and 30 B channels and 1 D channel in Europe and Australia. ISDN runs on the bottom three layers of the OSI reference model, and each layer uses a different specification to transmit data

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