CS25010

ISDN - Integrated Services Digital Network

"An ISDN is a network, in general evolving from a Telephony IDN that provides end-to-end digital connectivity to support a wide range of services, to which users have access by a limited set of standard multipurpose user-network interfaces"

CCITT I-Series recommendations on ISDN

Principles of ISDN
CCITT Recommendation 1.120 (1988)

- To support a wide range of voice and non-voice services.
- To support of a wide variety of applications including both switched and non switched connections.
- As far as practicable new services to be compatible with 64kbit/s switched digital connections.
- An ISDN will contain intelligence for providing service features, maintenance and network management functions.
- A layered protocol structure should be used for the specification of access to the ISDN.
- May be implemented in a variety of configurations...

An all digital network

- IDN "pushed" by
  - need for better quality voice
  - fast digital switching
  - high bandwidth fibre trunk system

- "pulled" by
  - desire to provide framework for ISDN
  - greater need for data communications

- Existing infrastructure expensive -subscriber loop

ISDN Services

- Bearer service
  - Provides connectivity.
  - No interpretation of the data or protocols.

- Tele services
  - Value adding.
  - Interprets protocols.
  - Provides extra services.

- Supplementary services

Types of Access

- Basic rate access
  - 2 B channels at 64kbit/s each
  - 1 D channel at 16 kbit/s each

- Primary rate access

  UK/Europe (2.048Mbps):
  - 30 B channels at 64kbit/s each
  - 1 D channel at 64kbit/s

  US, Canada, Japan (1.544Mbps):
  - 23B channels at 64kbit/s each
  - 1D channel at 64kbit/s

- B channel - voice, FAX, slow video, data
- D channel - signalling, telemetry, low speed data

Types of service

- Circuit switched over B channel.

- Semi permanent connections over B channel.

- Packet switched calls over B channel.

- Packet switched calls over D channel.

Types of User Interface

- NT1 - Network termination 1
  - physical and electrical termination (OSI 1)
  - supports multidrop line

- NT2 - Network Termination 2
  - intelligent device
  - perform switching and concentration functions

- TE1 - Terminal Equipment 1
  - equipment supporting the standard interface

- TE2 - Terminal Equipment 2
  - existing non ISDN equipment
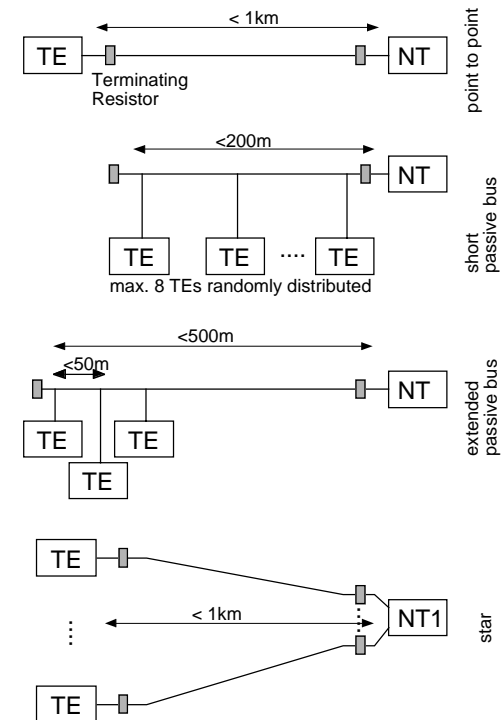
- TA - Terminal Adapter

Reference Points
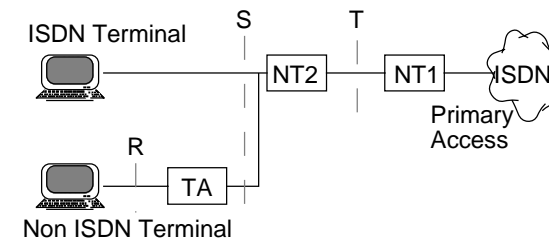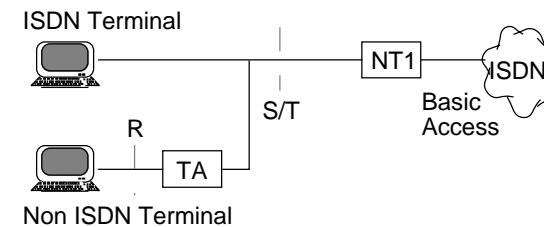
Basic Access Configurations

- A 'multidrop' configuration can be used, with up to **8 TEs**.
- Two devices can simultaneously transmit on two B channels.
- A contention resolution protocol detects collisions on the D channel.
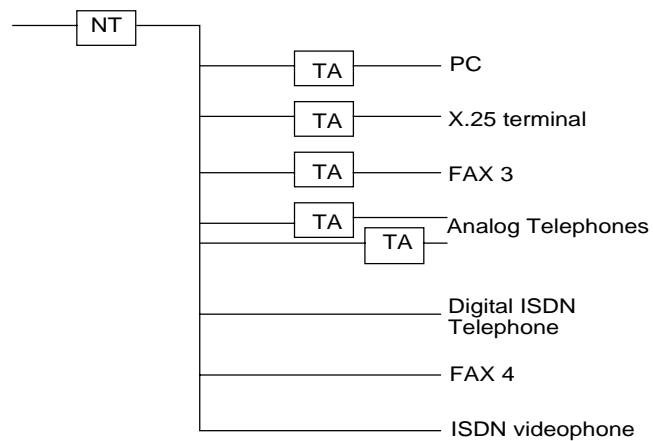
Basic Access Configurations

The Subscriber Loop
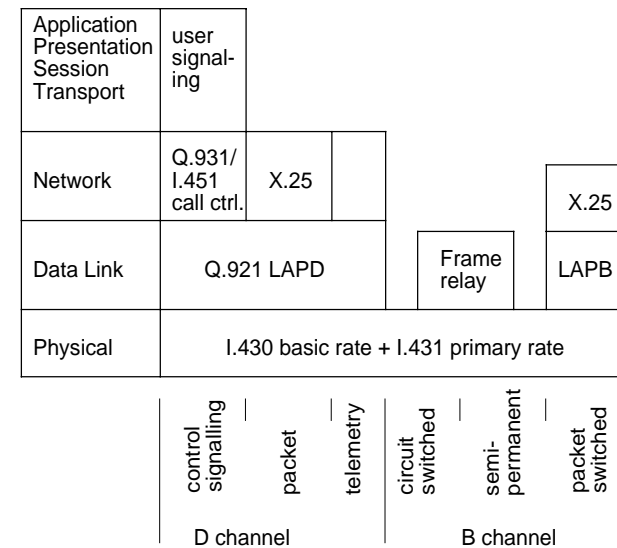
The requirements were:

- utilise existing twisted pair wire
- digital data
- required to support 2B+D (144kbit/s)
- full duplex

Possible solutions were:

- MODEMS...
- Time Compression Multiplexing (TCM)
- echo cancellation

Digital signal transmission using echo cancellation was chosen for the subscriber loop since it can support a range 4km rather than the 2km of TCM.

ISDN protocols

Application Presentation Session Transport	user signal-ing					
Network	Q.931/ I.451 call ctrl.	X.25				X.25
Data Link	Q.921 LAPD			Frame relay		LAPB
Physical	I.430 basic rate + I.431 primary rate					

control signalling   packet   telemetry   circuit switched   semi-permanent   packet switched

D channel   B channel

Protocols

Link level protocols

- LAP-D based on LAP-B
- LAP-B subset of HDLC (ISO 33009,4335)
- LAP-F Frame relay

Network level protocols

- I.451/Q.931 B channel control signalling over D channel
- X.25 packet level used for user packet data over B or D channels

LAP-D

Aims:

- multiple terminals at the user network interface (S/T)
- multiple "layer 3" entities in each device

Two types of service:

- Unacknowledged operation:
  - error detection but no error control
  - no flow control
- Acknowledged operation:
  - error control
  - flow control

Teleservices

CCITT defined teleservices:

- Telephony
- Teletex
- Telefax
- Mixed mode
- Videotex
- Telex
- Message Handling Service (MHS)
  X.400 E-mail

List does not include computer-computer
applications such as file transfer. These
are mostly defined by ISO.

Supplementary Services

Each supplementary service adds value to
an underlying Bearer service or
Teleservice

- Call Forwarding
- Closed User Group
- Calling Line Identification
  Presentation (CLIP)
- Calling Line Identification Restriction
  (CLIR)
- Advice of Charge at End of Call
  (AOC-E)
- plus many others...

Costs

- More than ordinary phone line to install & line rental- but price dropping.
- Call charges the same.
- Cost per bit less for data.
- Cost effective against leased line when used of the order of 3 hours or less per day.

Euro - ISDN

- 1989 Memorandum of Understanding
  - 26 operators
  - 20 countries
- in place end 1992
- implementation 1993
- provides a minimum set of standardised services

MoU - Minimum Set of Services and Facilities

- International Interface
- Basic Rate Access
- Primary Rate Access

- Circuit mode 64Kbit/s unrestricted
- Circuit Mode 3.1Khz audio

- CLIP and CLIR
- Direct Dialling In
- Multiple Subscriber Number
- Terminal Portability

Lower Priority Items

- Packet Mode - X.31 B channel
- Packet Mode - X.31 D channel
- Advice of Charge
- Call waiting
- conference
- call completion - busy
- call foreward
- call deflection
- free phone
- malicious call identification
- sub addressing
- three party
- user -user signalling