Integrated services Digital Network
Public networks are used for a variety of services
- Public Switched Telephone Network
- Private Lines (leased)
- Packet Switched Data Networks
- Circuit Switched Data networks
ISDN

- Users have a variety of equipment to connect to public networks
  - Telephones
  - Private Branch Exchanges
  - Computer Terminals or PCs
  - Mainframe Computers

- A variety of physical interfaces and access procedures are required for connection
The telephone network has evolved into a digital one with digital exchanges and links.

The signalling system has become a digital message-oriented common channel signalling system (SS#7).

The term ‘Integrated Digital Network’ is used to describe these developments.
ISDN Services

Teleservices

- Telephony
- Telefax
- Teletex
- Telex
- Teleconferencing

Bearer services

- Circuit switching
- Packet switching
- Frame relay
- Cell relay

Supplementary services

- Call waiting
- Reverse charging
- Message handling
Integrated Services Digital Network

Customer ISDN Interface

Telephone
Data terminal
PBX
Alarm
LAN

ISDN central office

Packet switched network
Circuit switched network
Databases
Other Networks & services

‘Digital pipe’
Integrated Digital Network

Diagram showing the components of an Integrated Digital Network (IDN), including modems, local loops (analog and digital), a telecommunication office, and digital pipes connecting to packet switches and circuit switches.
In Practice there are multiple networks providing the service nationally
The user however, sees a single network
Benefits to Subscribers

- Single access line for all services
- Ability to tailor service purchased to suit needs
- Competition among equipment vendors due to standards
- Availability of competitive service providers
Architecture

Common physical interface

ISDN central office

Integrated Digital Network

- Digital circuit-switched backbone
- Packet-switched network
- Network-based processing services

ISDN subscriber loop
- Basic 2B+D
- Primary 30B+D
ISDN Channels

- The Digital pipe is made up of channels - one of three types
- B channel, D channel or H channel
- Channels are grouped and offered as a package to users
B Channel

- B channel-64 kbps
- B is basic user channel
  - can carry digital data or PCM-encoded voice
  - or mixture of lower rate traffic.
B Channel

- Four kinds of connection possible
- Circuit-switched
- Packet-switched - X.25
- Frame mode - frame relay (LAPF)
- Semipermanent - equivalent to a leased line
D Channel

- D Channel - 16 or 64 kbps
- Carries signalling information to control circuit-switched calls on B channels
- Can also be used for packet switching or low-speed telemetry
H Channel

- Carry user information at higher bit rates 384kbps or 1536kbps or 1920kbps
- Can be used as a high-speed trunk
- Can also be subdivided as per user’s own TDM scheme
- Uses include high speed data, fast facsimile, video, high-quality audio
## ISDN Channels and their Applications

<table>
<thead>
<tr>
<th>B Channel (64 kbps)</th>
<th>D Channel (16/64 kbps)</th>
<th>H Channel (384/1536 kbps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital voice</td>
<td>Signalling (using SS#7)</td>
<td>High-speed trunk</td>
</tr>
<tr>
<td>High-speed data</td>
<td>Low-speed data, (e.g.</td>
<td>Very high speed data</td>
</tr>
<tr>
<td>(e.g. packet and</td>
<td>packet, terminal,</td>
<td></td>
</tr>
<tr>
<td>circuit switched data)</td>
<td>videotex)</td>
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<tr>
<td>Other (e.g. fax, slow</td>
<td>Other (e.g. telemetry)</td>
<td>Other (e.g. fast fax,</td>
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<tr>
<td>video)</td>
<td></td>
<td>Video)</td>
</tr>
</tbody>
</table>
ISDN Channel Groupings

- **Basic Access** -
  - two 64 kbps B channels
  - plus one 16kbps D channel
- **B channels** can be used for voice and data
- **Simultaneous calls** to separate destinations supported
- **D channel** used for signalling and also for data using X.25
ISDN Basic Access

- Intended for small business and residential use
- A single physical interface is provided
- Data rate is 144kbps plus 48kbps overhead bits totalling 192 kbps
- Most existing subscriber loops can support basic access
Basic Rate Interface

BRI 192 Kbps

64(B1) + 64(B2) + 16(D) + 48 (overhead)

= 192 Kbps
BRI Frame

BRI = 4000 frames/s = 4000 \times 48 \text{ bits/frame} = 192 \text{ Kbps}

Frame 4000

Frame 2

Frame 1

48 bits (16 bits for B1, 16 bits for B2, 4 bits for D, and 12 bits overhead)
ISDN Primary Access

- Intended for users with greater capacity requirements
- Example would be a digital PBX
- Two standards exist
  - 1.544 Mbps American
  - 2.048 Mbps European
PRI Frame

PRI = 8000 frames/s = 8000 * 193 bits/frame
    = 1.544 Mbps
Primary Rate Interface

23 X 64(B1 – B23) + 64 (D) + 8 (overhead) = 1544
User Access

- Defined using two concepts
  - Functional groupings of equipment
  - Reference points to separate functional groupings
Typical User Access Layout

ISDN Telephone

PC with ISDN Interface Card

Integrated Voice/data Terminal

NT

2-wire Subscriber Loop

4-wire S-bus

User/network Interface

Up to 8 devices point to multi-point mode