ISDN Analysis

# ISDN – A Brief Overview

- Allows the transmission of voice, data, video and graphics, at very high speeds, over standard communication lines

- Operates at Layer 3 – Network Layer

- Used in Switched and non-switched circuit & packet networks

- ITU-T standard defines number of component parts & functions of ISDN

  ➢ ISDN CHANNELS

  ➢ ACCESS TYPES

  ➢ DEVICES

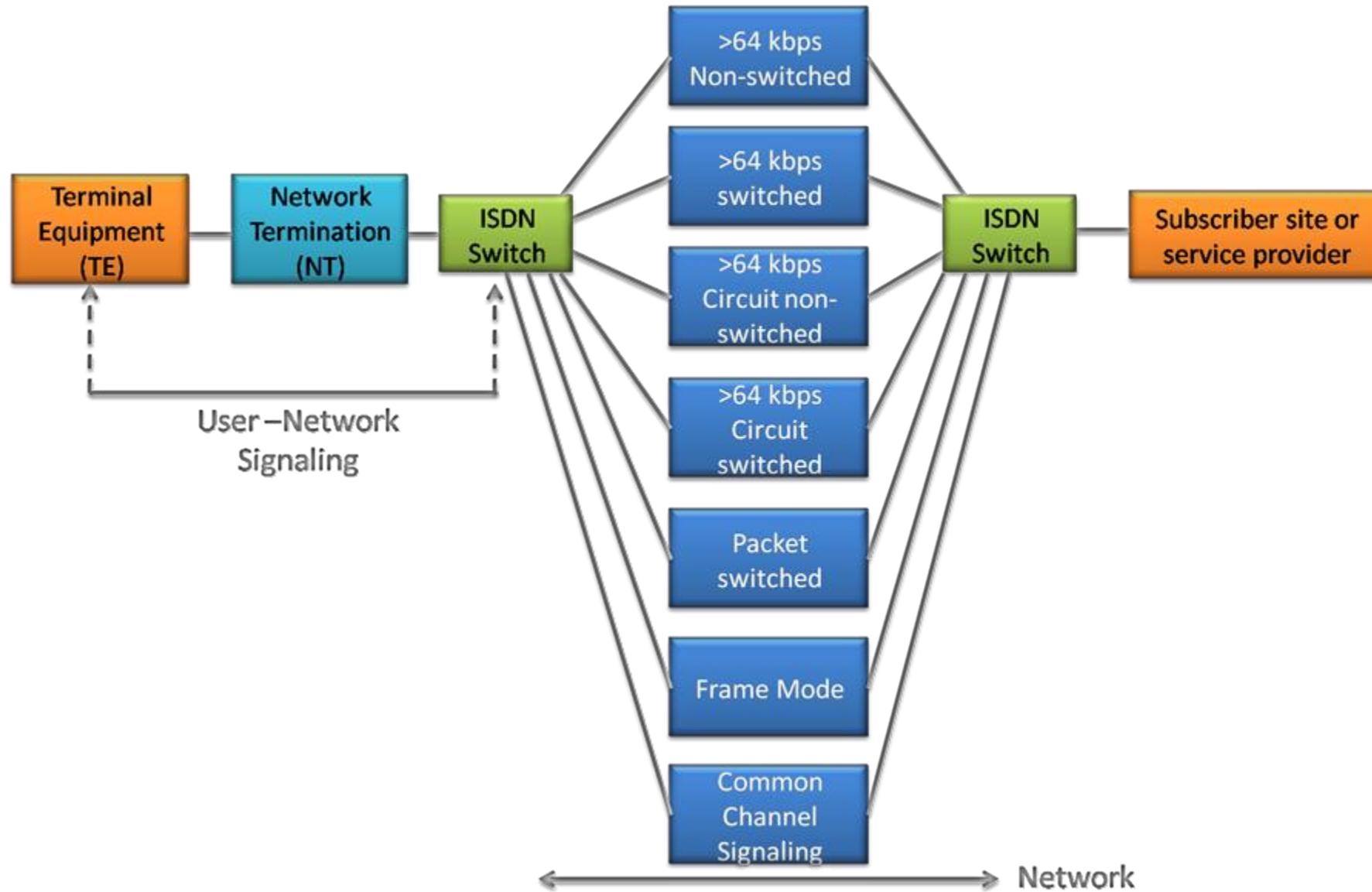 ➢ PROTOCOLS

ISDN Conceptual View
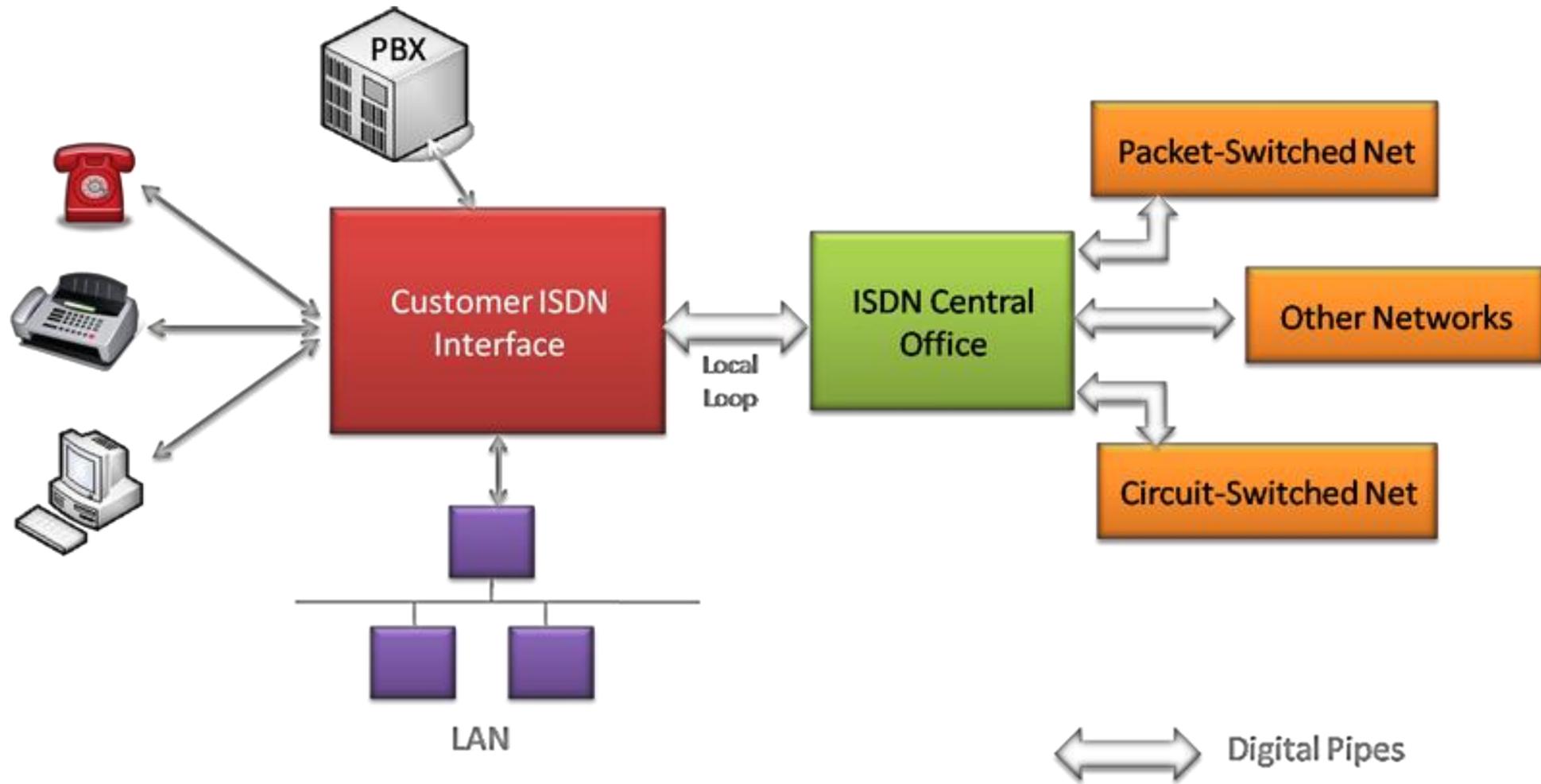
ISDN Interface and Devices
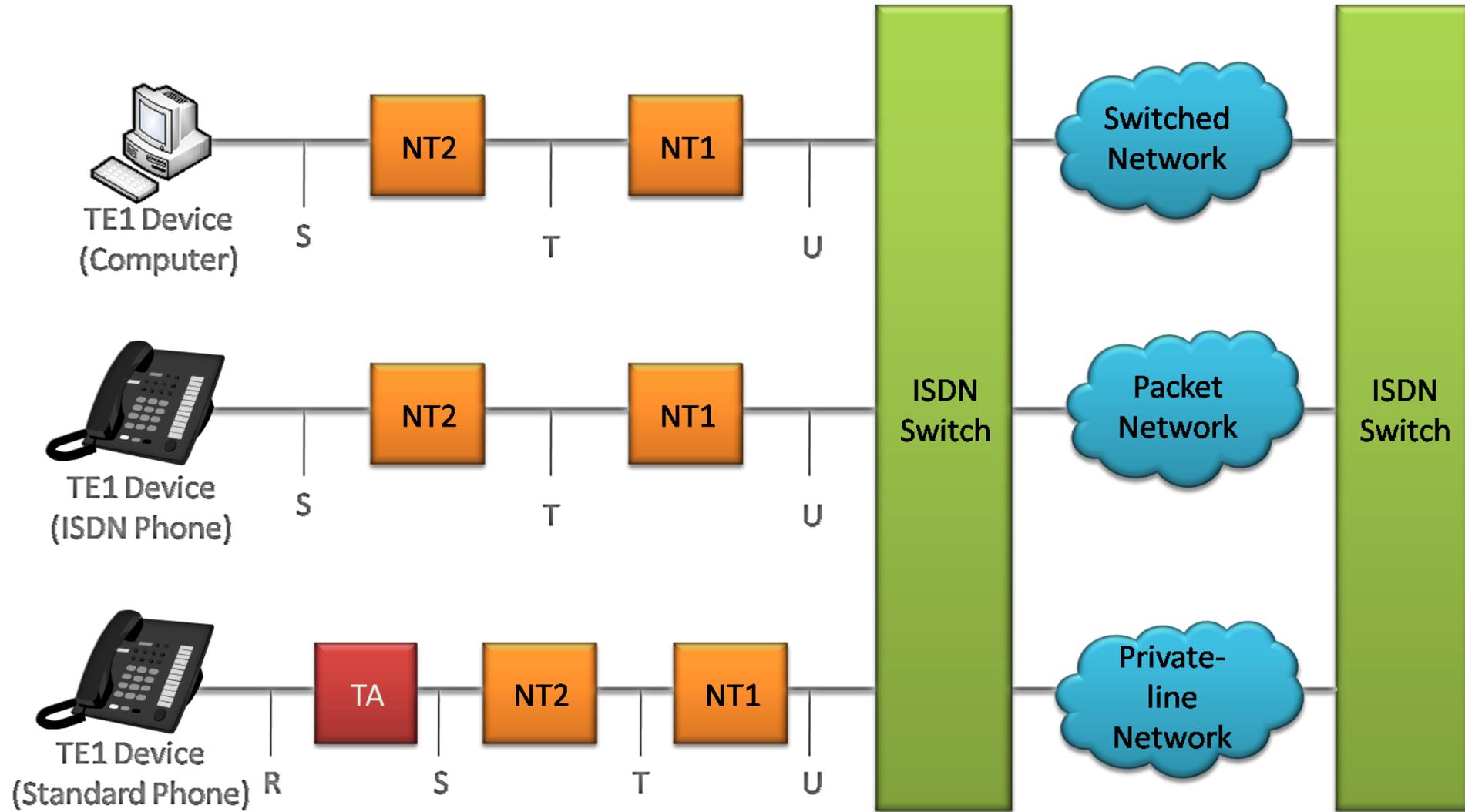
ISDN Basics

- ISDN Devices

  - ➤ Terminal Equipment (TE)

  - ➤ Terminal Adapter (TA)

  - ➤ Network Termination 1 (NT1)

  - ➤ Network Termination 2 (NT2)

  - ➤ Exchange Termination (ET)

ISDN Architecture

ISDN Basics

- Types of channels

  ➢ Bearer channel (B-channel=64 kb/s) clear pipe for data

  ➢ Delta channel (D-channel, 16 kb/s or 64 kb/s) call signaling information:

    o who is calling

    o type of call

    o calling what number

  ➢ High-capacity channels (H channels)

    o An H channel is a special, high-speed clear channel. H channels, designed primarily for full-motion color video, are not yet in common use

General types of Services

- Basic Rate Interface (2 B channels + 1 D channel (16 kb/s))

  ➤ Composition: 2B+D (16 kbps D-channel) + synchronization and framing = 192 kbps

  ➤ Intended to meet the needs of individual users (residences, small offices)

  ➤ Most existing two-wire local loops can support this interface

- Primary Rate Interface (30 B channels + 1 D channel (64 kb/s))

  ➤ In U.S.: 23B+D (64 kbps D-channel) = 1.544 Mbps (T1)

  ➤ In Europe: 30B+D (64 kbps D-channel) = 2.048 Mbps (E1)

  ➤ Users w/ greater capacity requirements (offices w/ a PBX or LAN)

  ➤ May also be used to support H-channels (e.g. 3H0+D supplies a 1.544 Mbps interface)
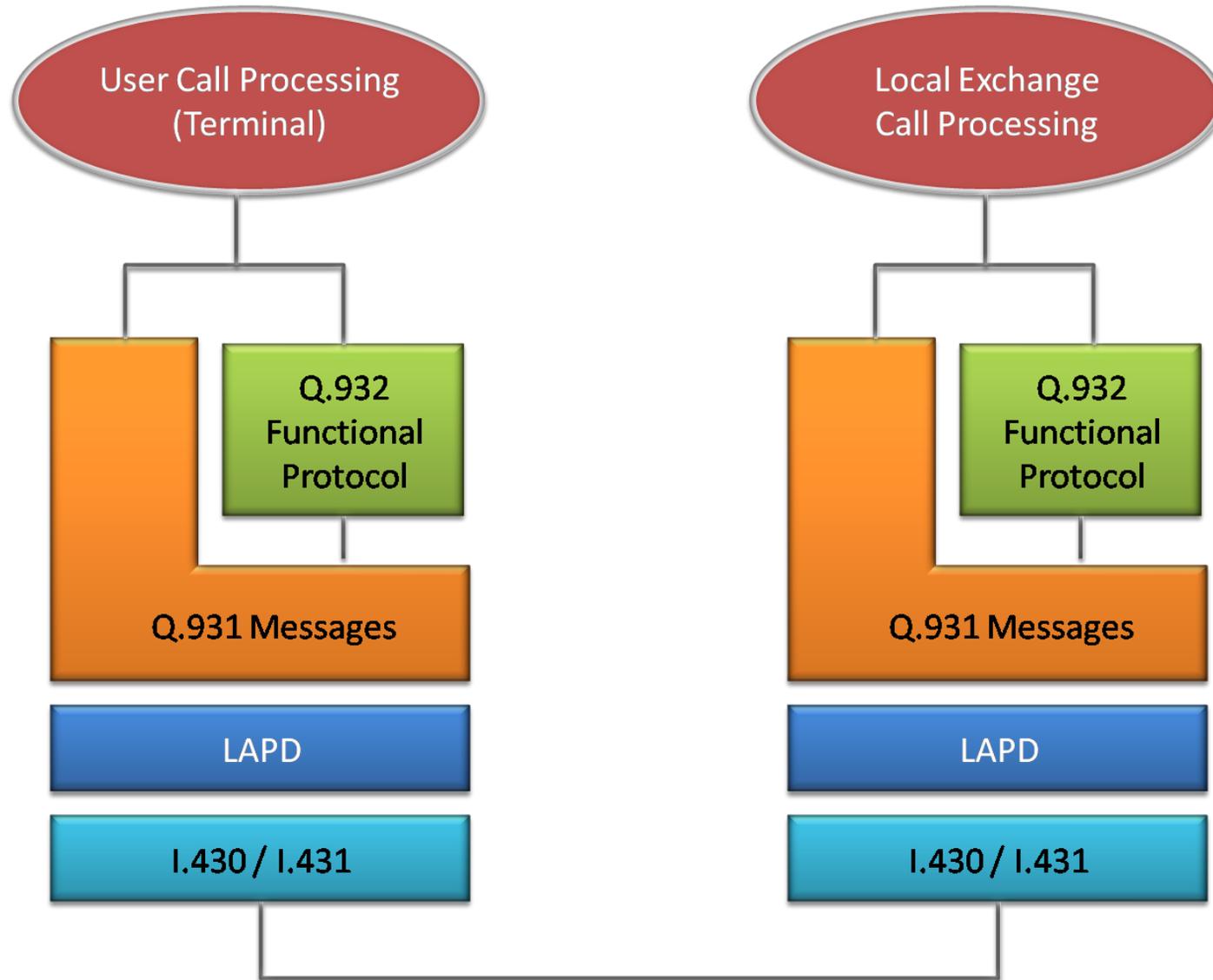
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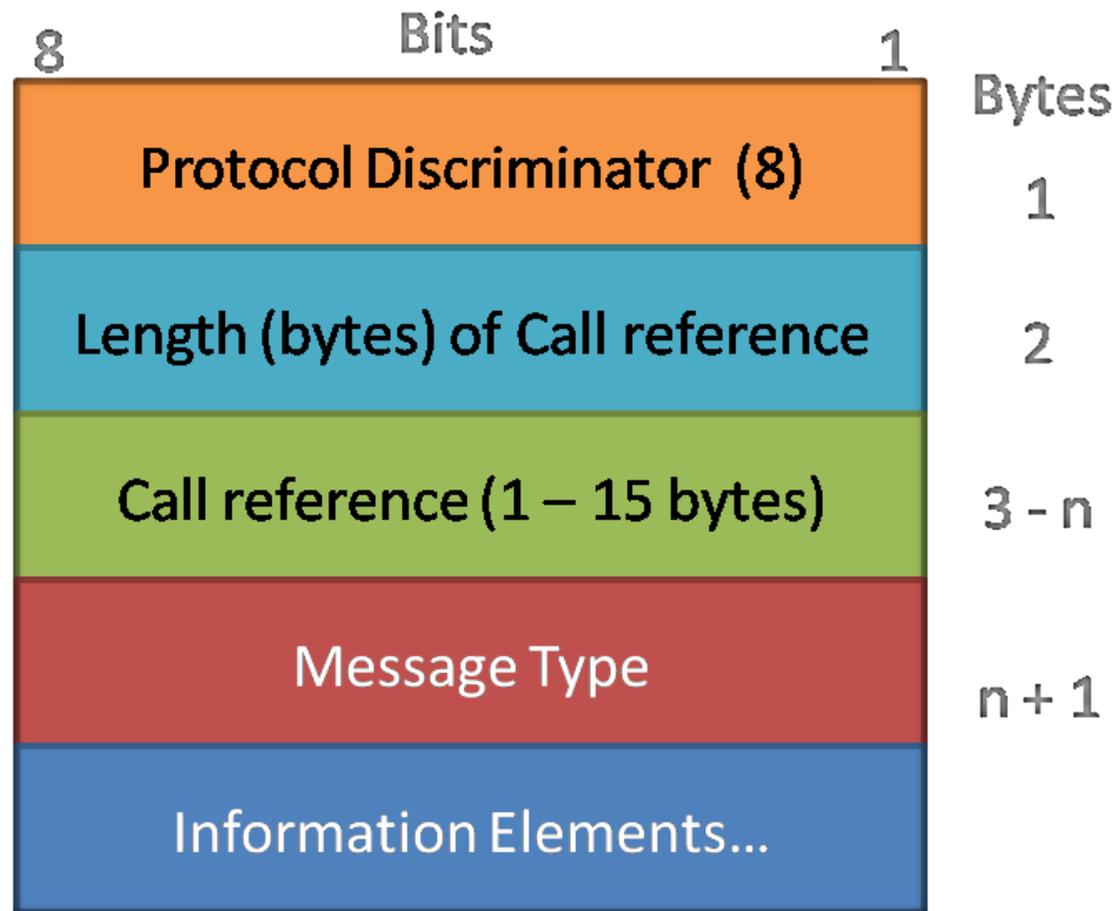
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ISDN Services : PRI & BRI
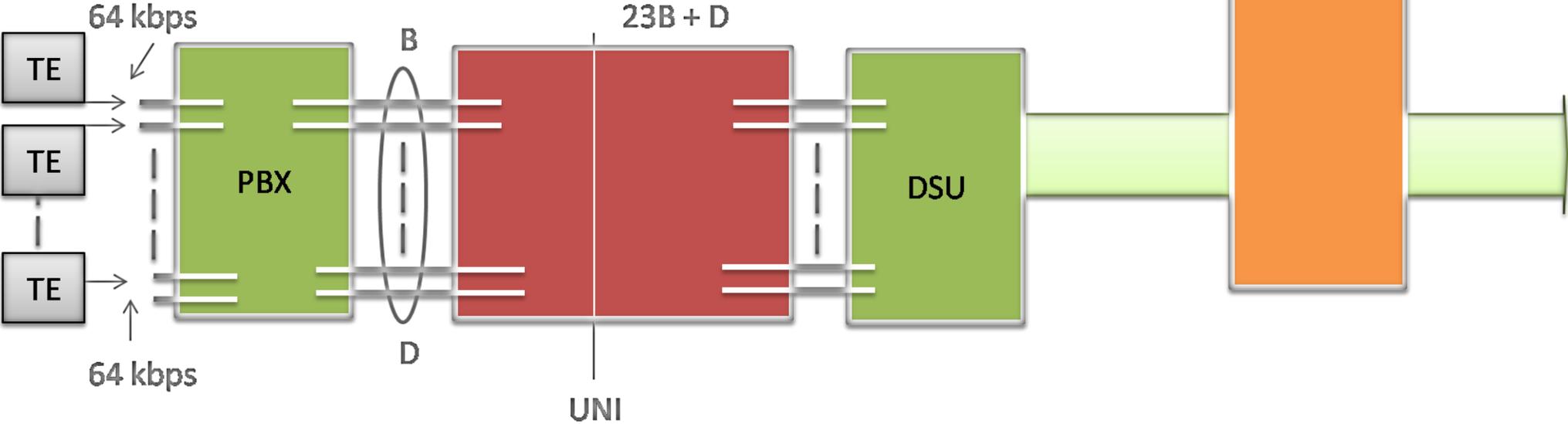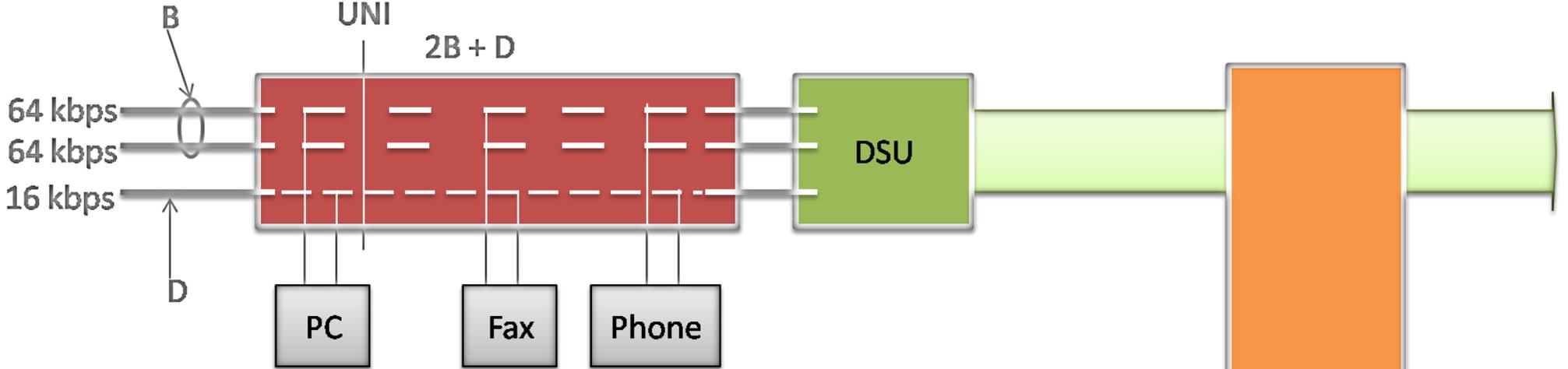
ISDN Protocol Structure
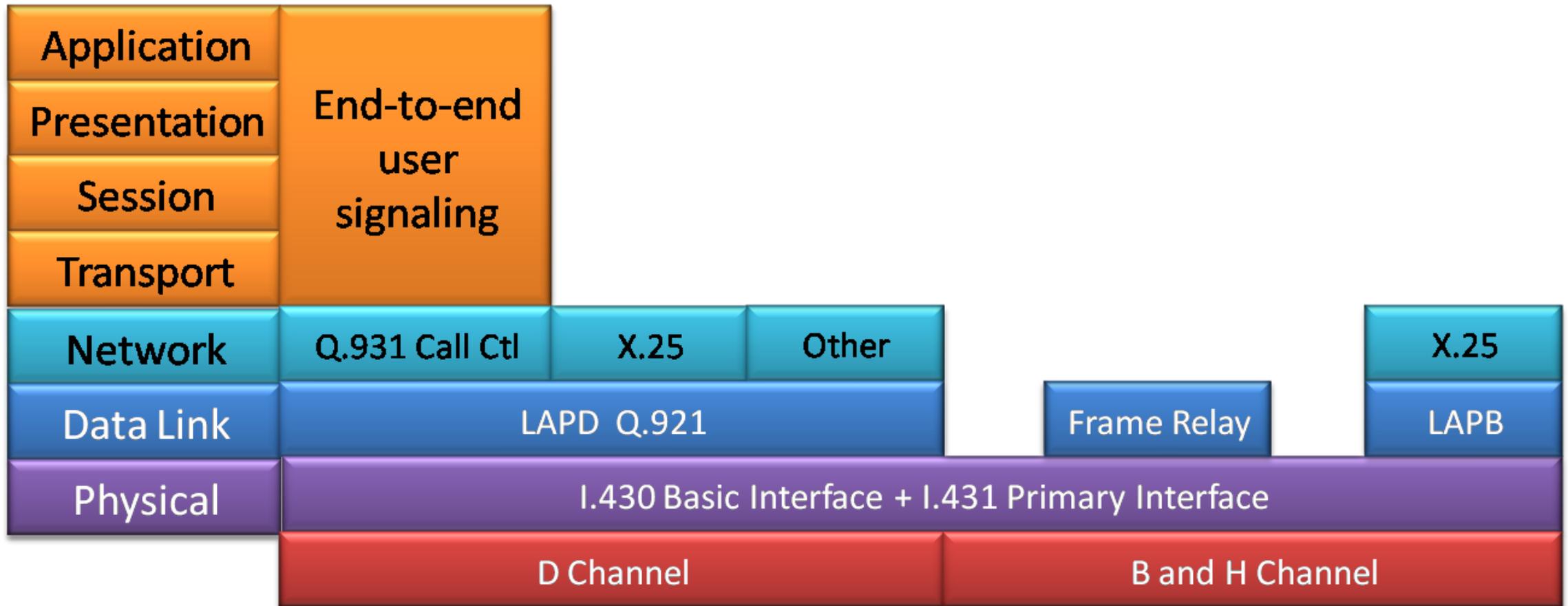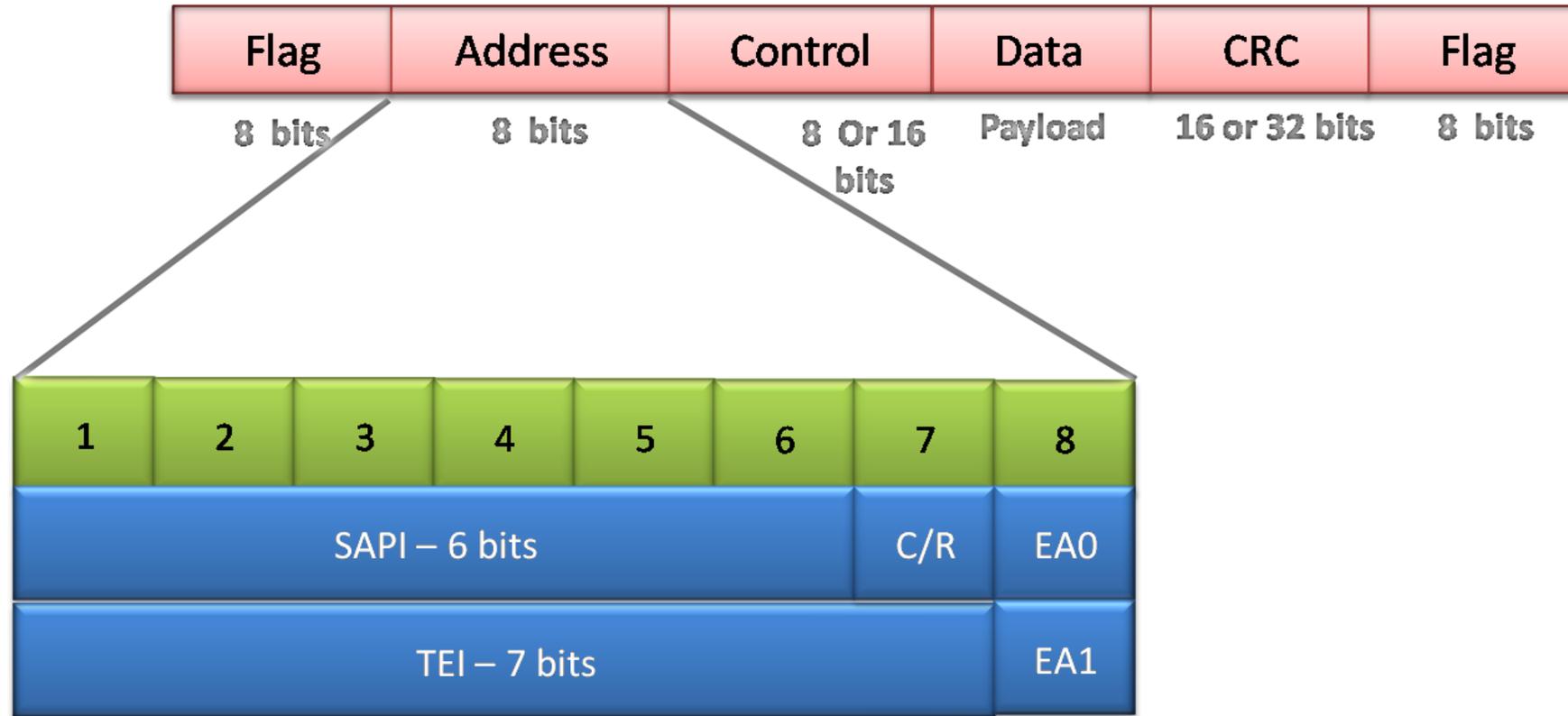
ISDN Layer 3 Protocol

Q.931 Frame Format

ISDN Layer 2 Protocol
Link Access Protocol – D Channel (LAPD)

- Layer 2 protocol

- Almost identical to LAP-B used w/ X.25 (based on HDLC)

- Provides unacknowledged information-transfer service (unnumbered frames, error detection to discard frame but no error control or flow control) and acknowledged information transfer
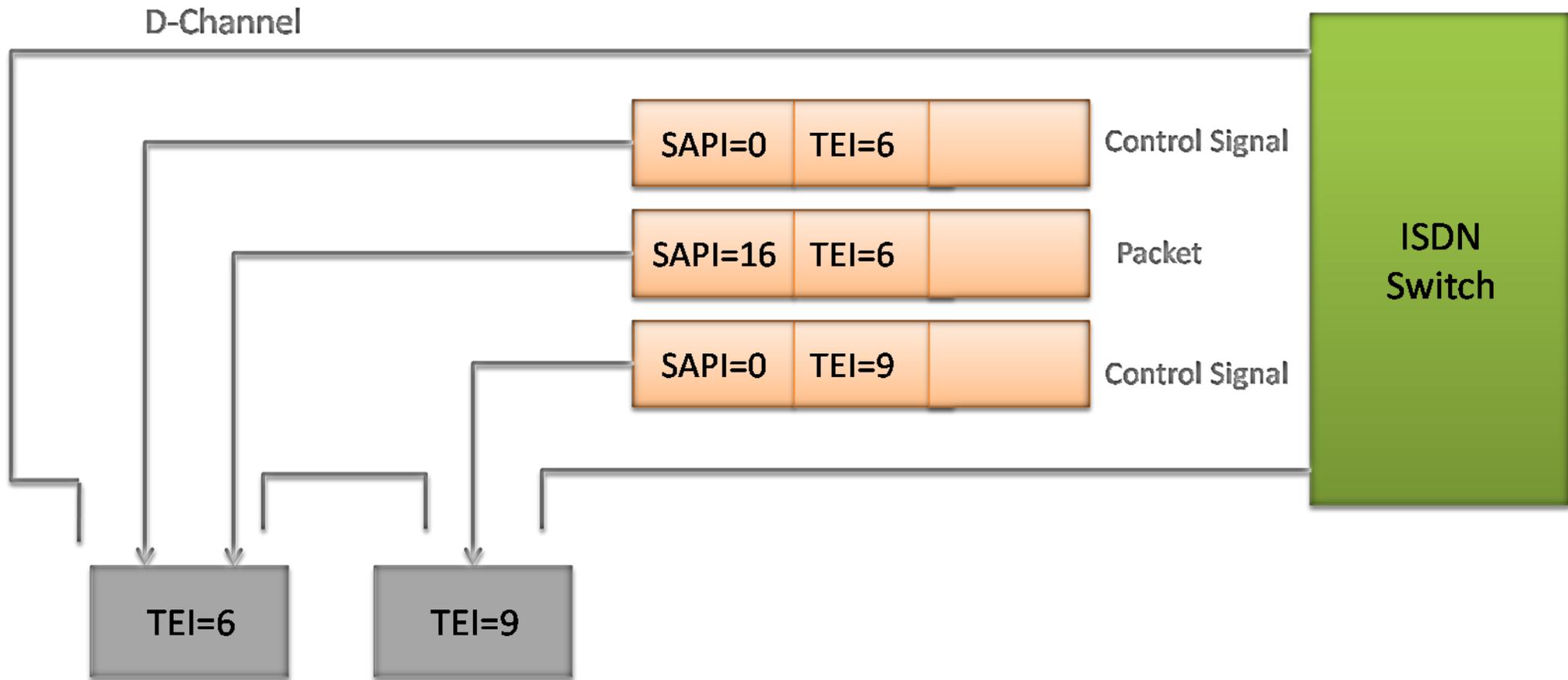
LAPD Frame Format

Flag	Address	Control	Data	CRC	Flag
8 bits	8 bits	8 Or 16 bits	Payload	16 or 32 bits	8 bits

1	2	3	4	5	6	7	8
SAPI – 6 bits						C/R	EA0
TEI – 7 bits							EA1

SAPI – Service Access Point Identifier
C/R – Command/Response
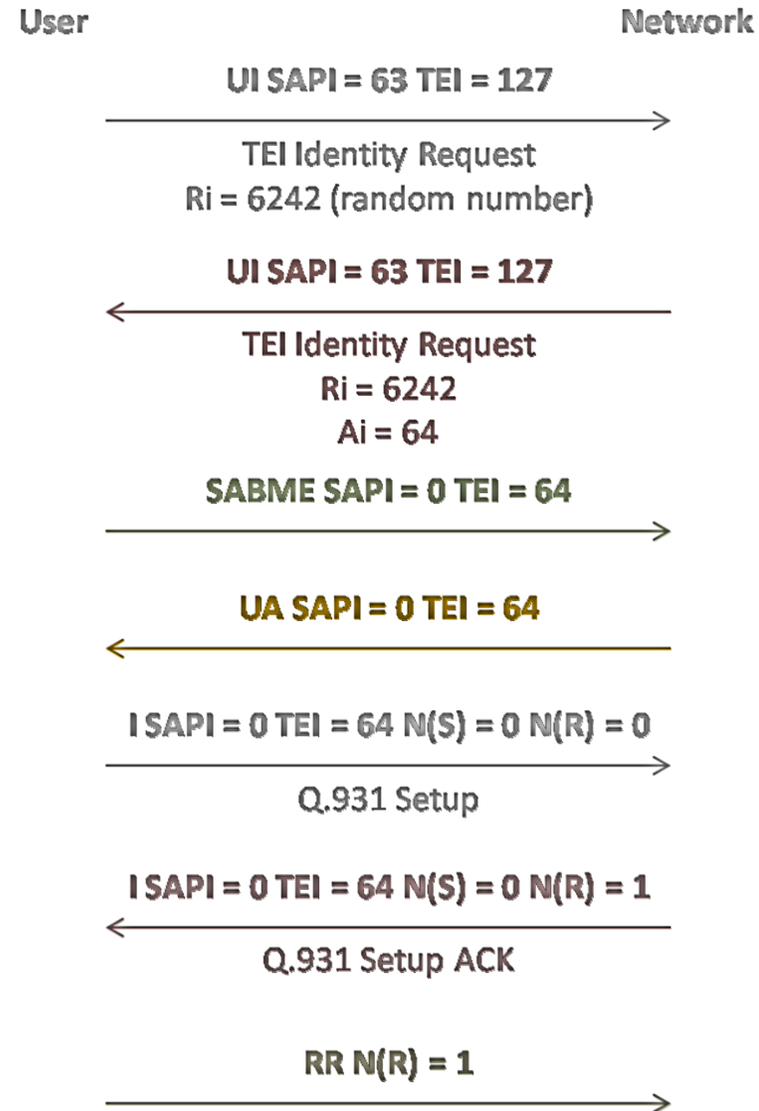EA – Extended Address field
TEI – Terminal Endpoint Identifier

Address Field of LAP-D Frame Format

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LAPD Channel

End-to-end Mode

Sample Exchange b/w User & Network

User   Network

UI SAPI = 63 TEI = 127

→

TEI Identity Request
Ri = 6242 (random number)

UI SAPI = 63 TEI = 127

←

TEI Identity Request
Ri = 6242
Ai = 64

SABME SAPI = 0 TEI = 64

→

UA SAPI = 0 TEI = 64

←

I SAPI = 0 TEI = 64 N(S) = 0 N(R) = 0

→

Q.931 Setup

I SAPI = 0 TEI = 64 N(S) = 0 N(R) = 1

←

Q.931 Setup ACK

RR N(R) = 1

→

ISDN Call Flow
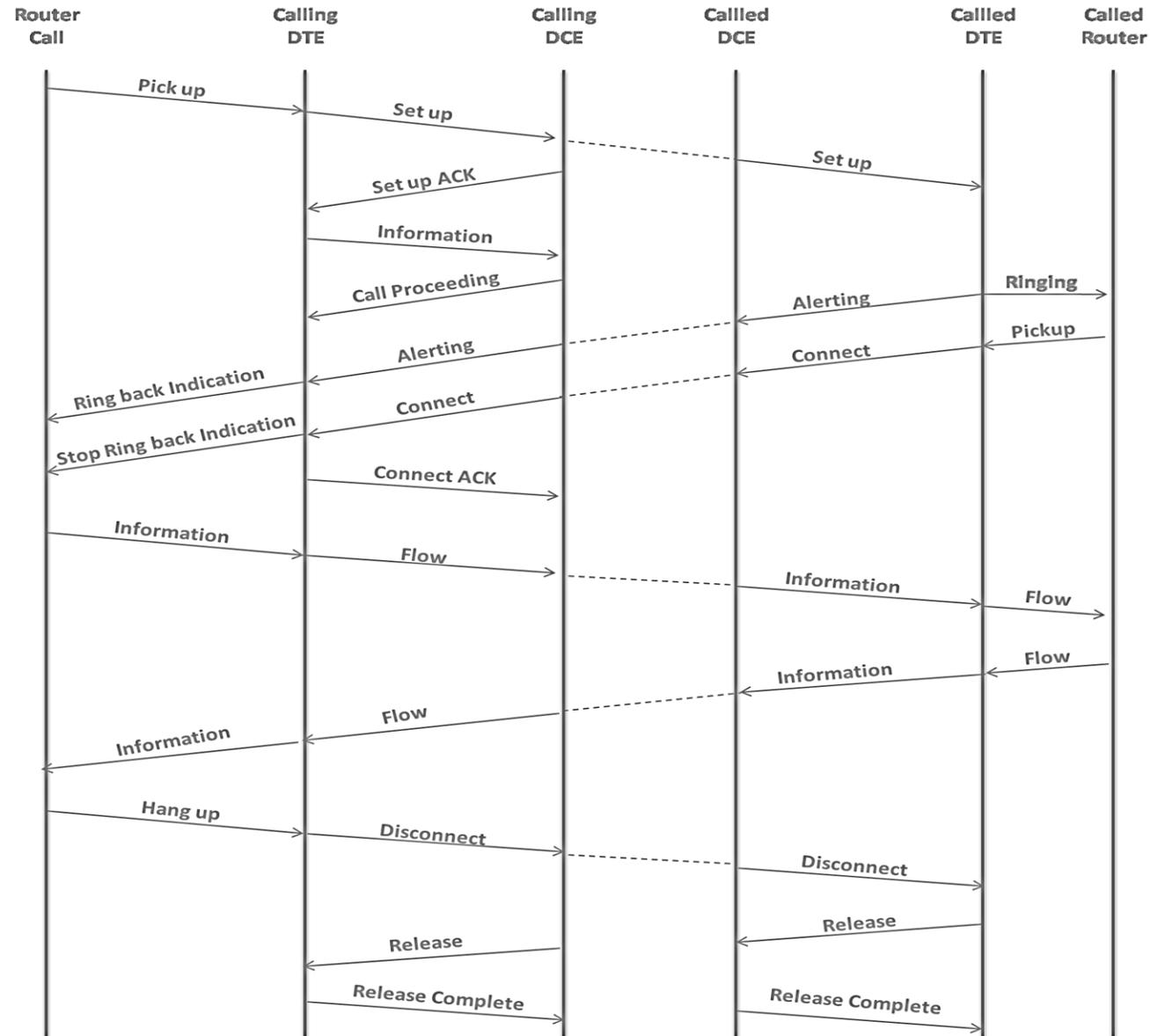
Advantages of ISDN

- **Digital**

  ➢ reliable connection

- **Speed**

  ➢ faster (192 kbps in BRI, 1.5 Mbps to 2.048 Mbps in PRI)

- **Fast call setup**

  ➢ 2 seconds

- **Bandwidth on Demand**

  ➢ adding new channels to the bundle of channels

- **Multiple devices**

  ➢ phone, fax, PC, videoconferencing system, router, terminal adapter, each with its own sub-
     address

Advantages of ISDN

- To network providers

  ➢ standards support universality and larger potential market for services, drive down equipment costs

- To manufacturers

  ➢ larger potential market, economies of scales

  ➢ standards decrease risk of obsolescence

- To enhanced service providers

  ➢ simplified user access

GL's ISDN Analyzer
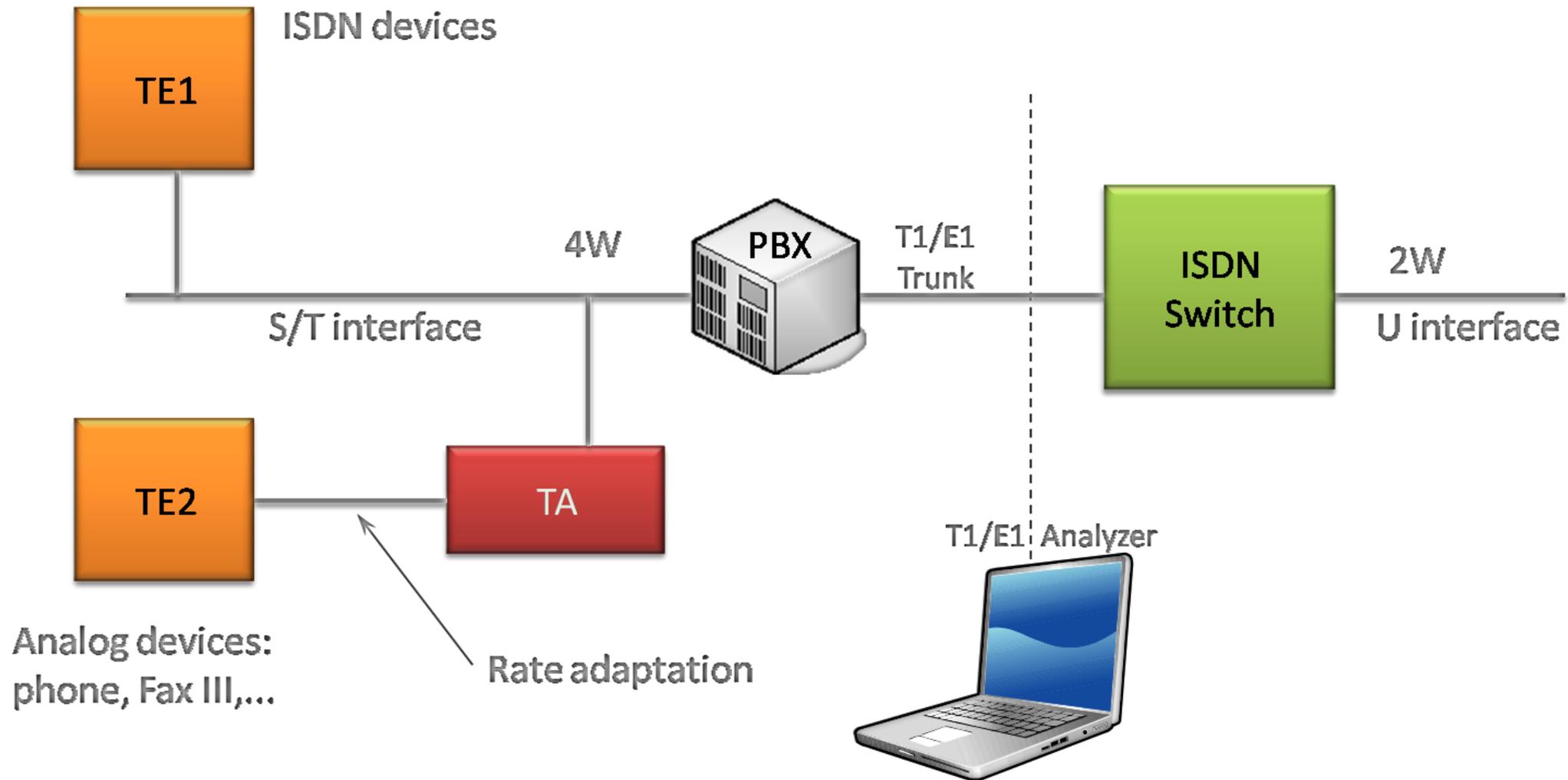
Protocol Standards Supported by GL's ISDN Analyzer
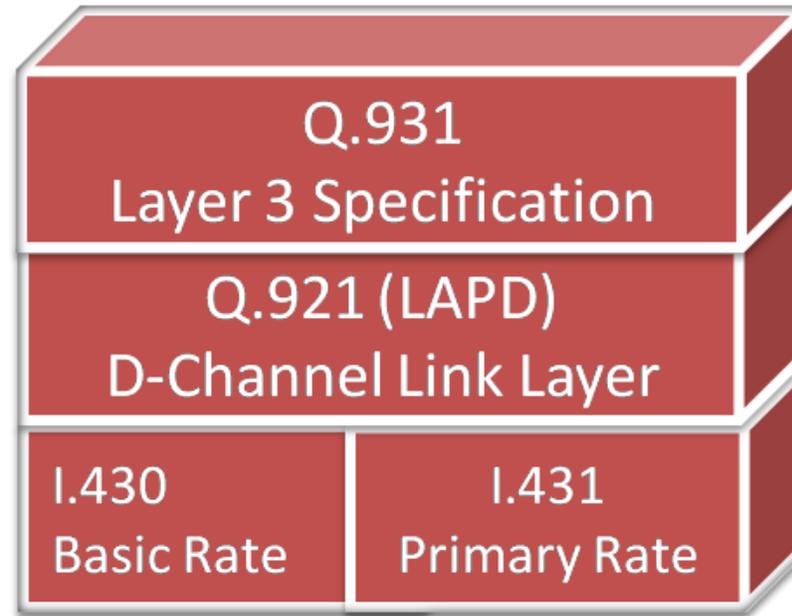
- BELL NI2

- DMS -100, DMS -250

- ANSI – T1.607

- QSIG ETSI

- Q.93x

- 4ESS

- 5ESS

- ETSI 300- 102

GL's ISDN Analyzer

Protocol Standard

- Layer 2 Protocols - LAPD is parsed according to Q.921

- Layer 3 Protocols includes -
  - ➢ Bell NI2 (Bellcore National ISDN-2),
  - ➢ AT&T/Lucent switch 4ESS and 5ESS,
  - ➢ ETSI 300-102
  - ➢ QSIG (Q-reference point Signaling System) ETSI
  - ➢ Q.93x (ITU implementation of ISDN) & ISDN ANSI decode
  - ➢ Nortel's switch DMS-100/250

- MLPP (Multi-Level Precedence. and Preemption) procedures for – (ISDN ANSI decode, ITU implementation - Q.955.3 & Facility Information Element - Q.932)

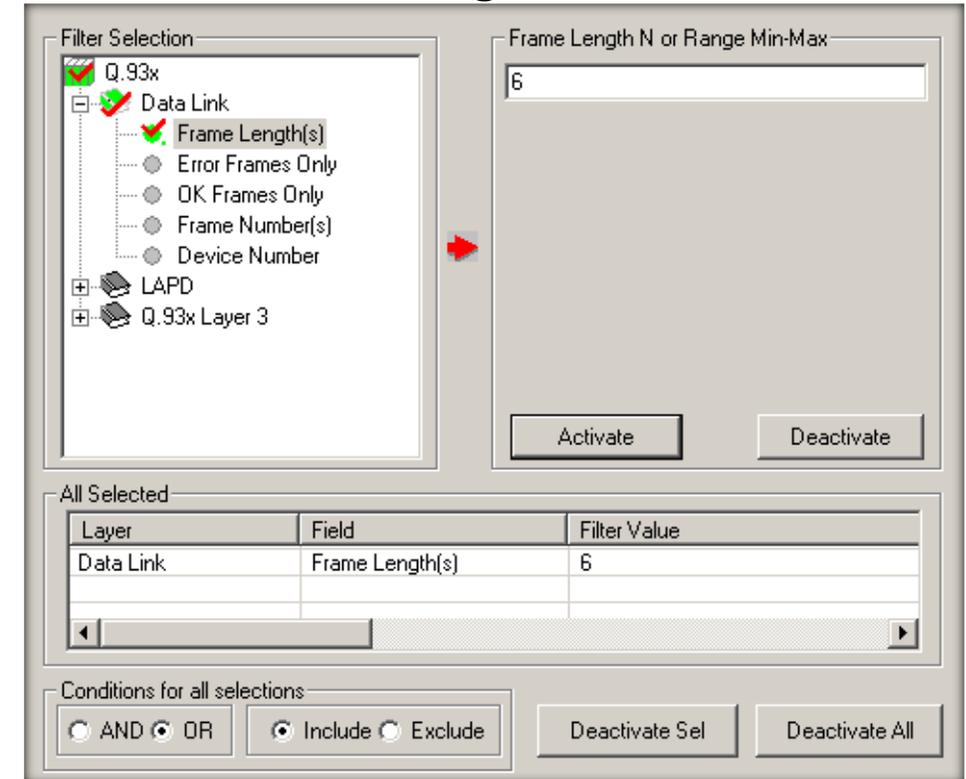# Call Detail Records

- Call trace defining important call specific parameters such as call ID, status (active or completed), duration, CRV, release complete cause etc are displayed

Filter Frames

Filtering Criteria

Real-time Capture Filter
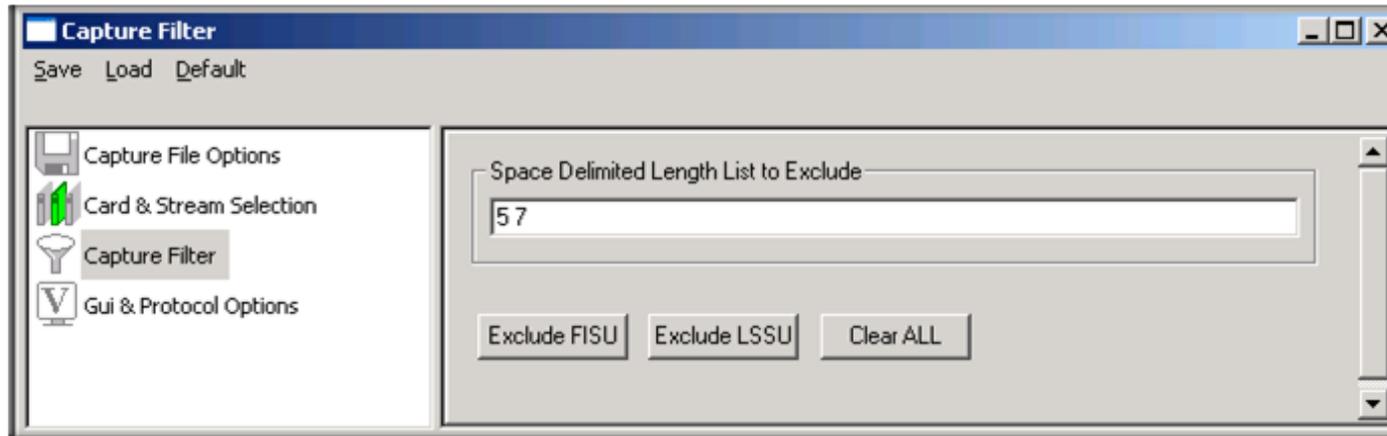

- Isolate certain specific frames from all frames in real-time as well as offline
- Real-time Filter applies to the frames being captured and is based on the Frame Length
- The frames can also be filtered after completion of capture according to SAPI, TEI, C/R, N (S), N(R), P/F, Supervisory Function and Type of ISDN Message

Search Frames

- Search features helps users to search for a particular frame based on specific search criteria
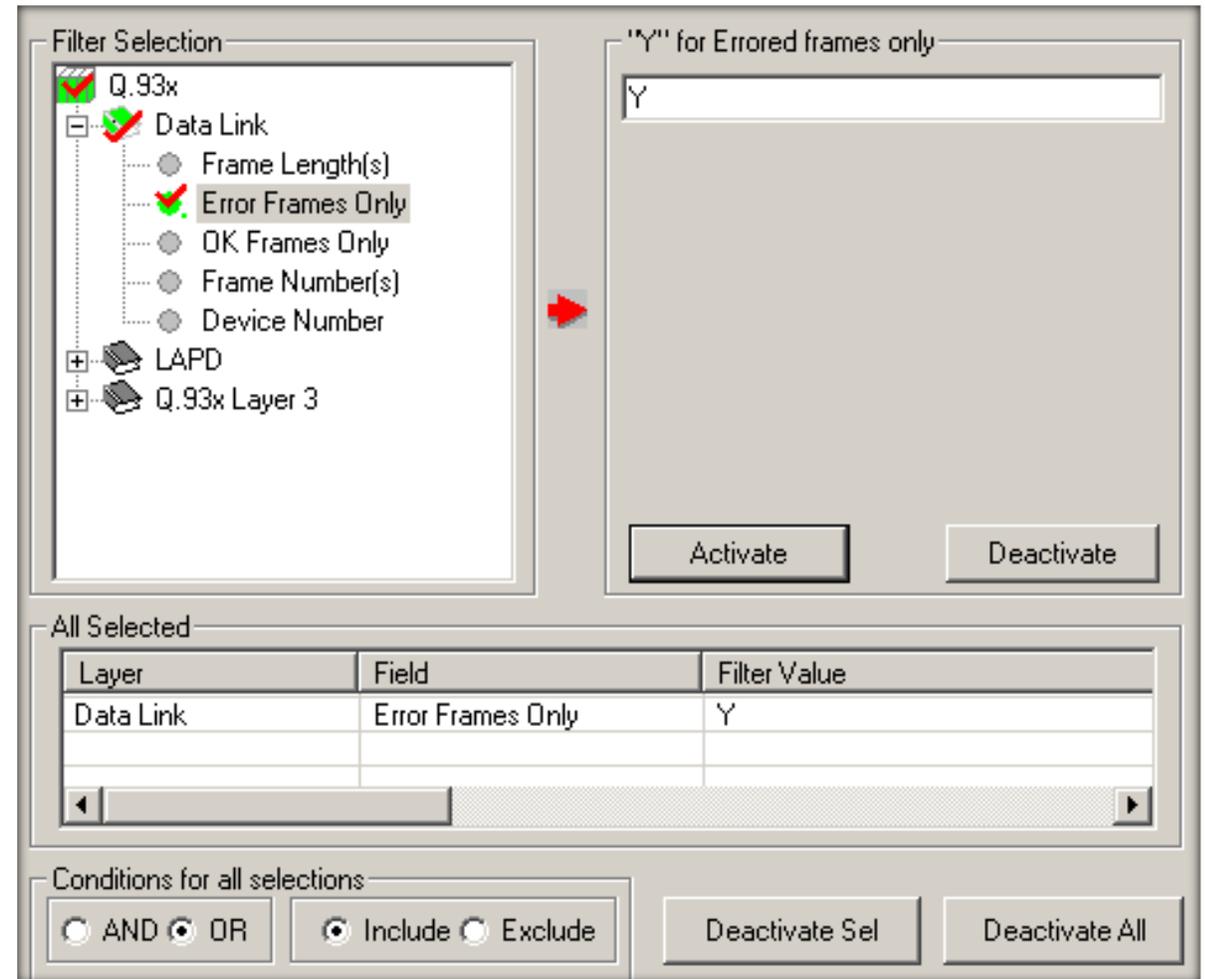
Statistics

- Statistics is an important feature available in protocol analyzer and can be obtained for all frames both in real-time as well as offline mode
- Numerous statistics can be obtained to study the performance of the network based on protocol fields and different parameters
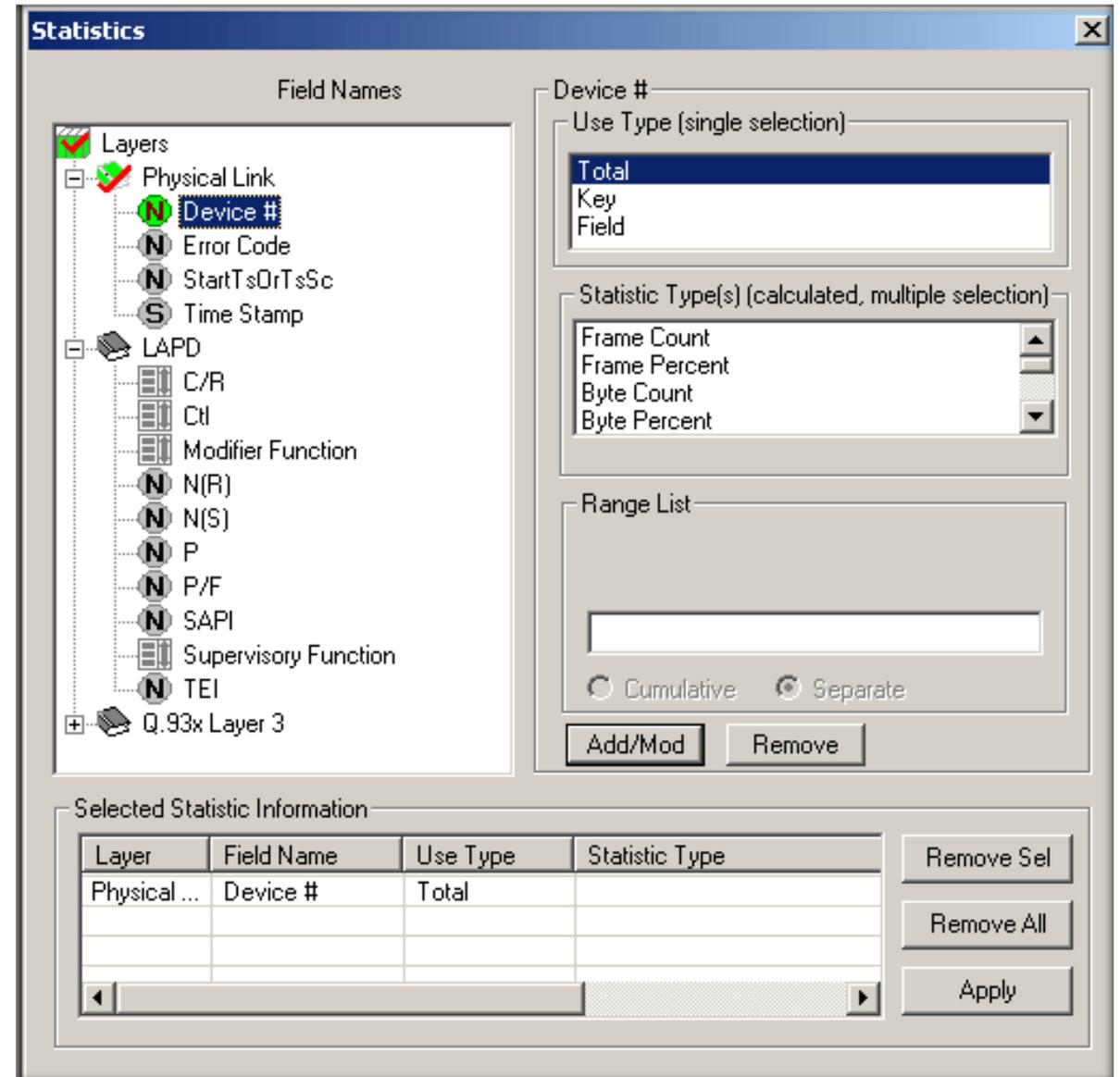
Applications

- Can be used as independent standalone units as "probes" integrated in a network surveillance systems

- Triggering, collecting, and filtering for unique subscriber information and relaying such information to a back end processor

- Collecting Call Detail Records (CDR) information for billing

THANK YOU!