

# Telecommunication systems

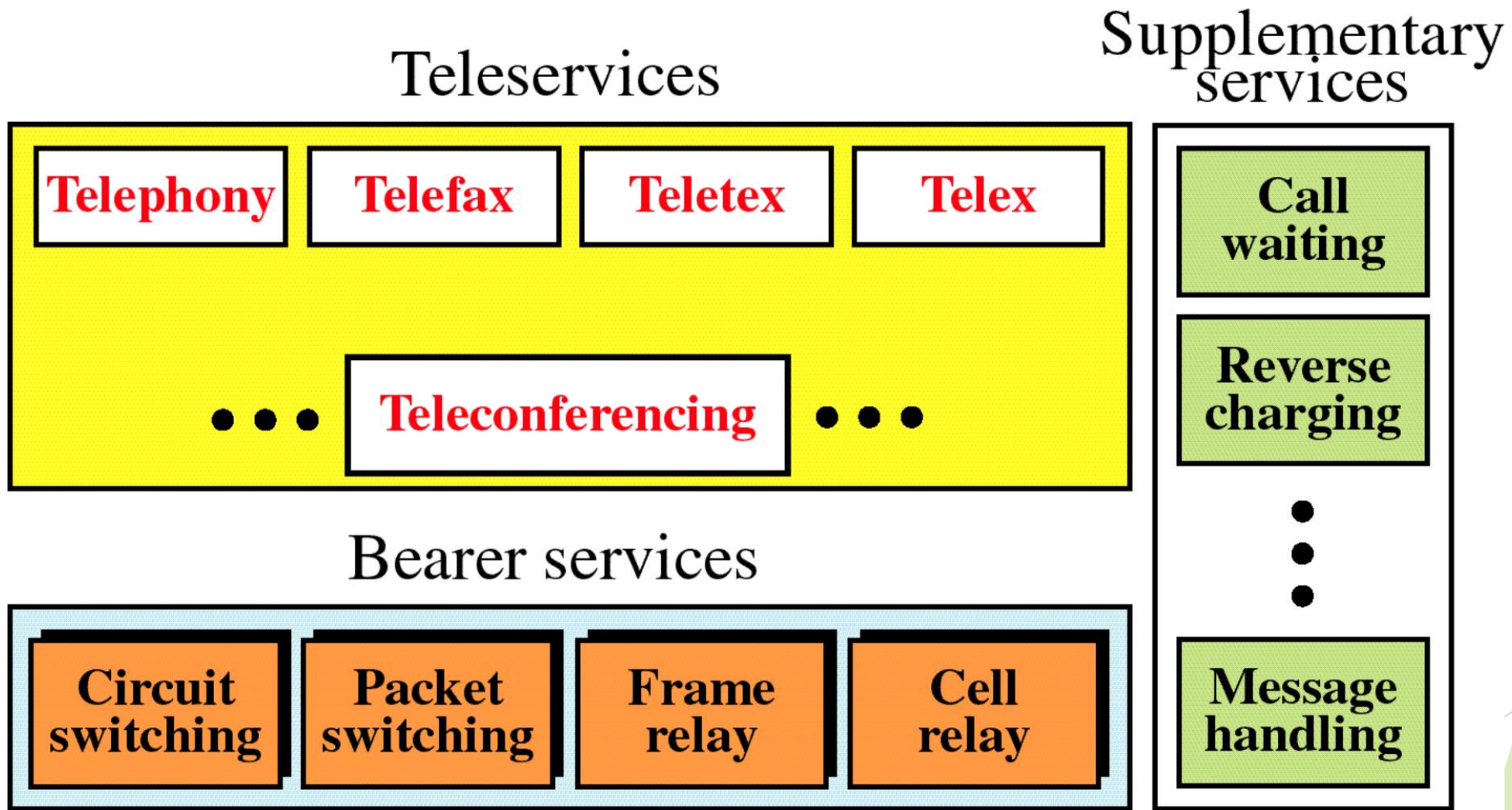
# Overview

- ▶ Telephone companies developed **ISDN (Integrated Services Digital Network)** as part of an effort to standardize subscriber services.
- ▶ This included the **User-Network Interface (UNI)**, better known as the local loop.
- ▶ The ISDN standards define the hardware and call setup schemes for end-to-end digital connectivity.
- ▶ These standards help achieve the goal of worldwide connectivity by ensuring that ISDN networks easily communicate with one another.
- ▶ In an ISDN network, the digitizing function is done at the user site rather than the telephone company.

# Overview

- ▶ Unlike POTS, ISDN is digital from end to end.
- ▶ With asynchronous connections (POTS) the local loop is analog and requires PCM (Pulse Code Modulation) - explained later.
- ▶ Benefits of ISDN include:
  - ▶ Carries a variety of user traffic signals, including data, voice, and video
  - ▶ Offers much faster call setup than modem connections
  - ▶ B channels provide a faster data transfer rate than modems
  - ▶ B channels are suitable for negotiated Point-to-Point Protocol (PPP) links

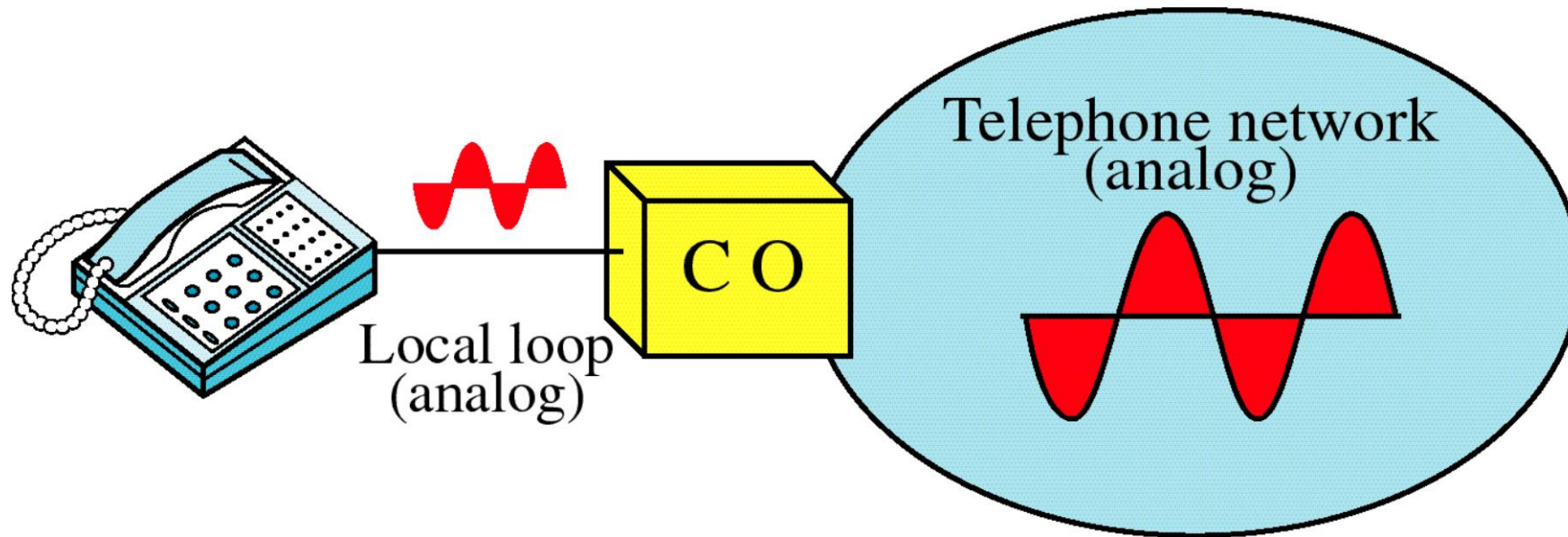
# ISDN Services



# ISDN - Motivation

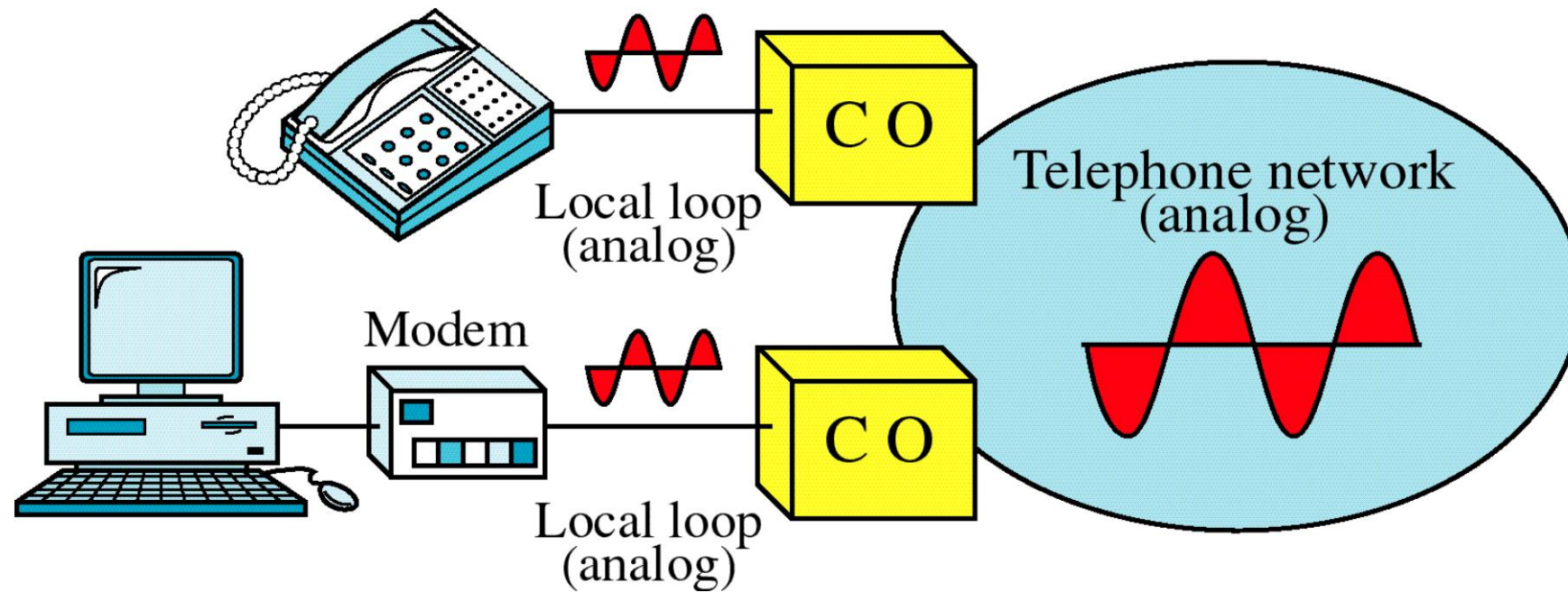
- ▶ Requirement for higher level telecommunication services
  - ▶ Better speech quality than PSTN
  - ▶ additional services :
    - ▶ conference call
    - ▶ Display phone number
    - ▶ call forwarding
    - ▶ Call waiting
    - ▶ video telephony
    - ▶ faster data transfer
- ▶ Solution: digitization - ISDN

# Voice over Analog Network

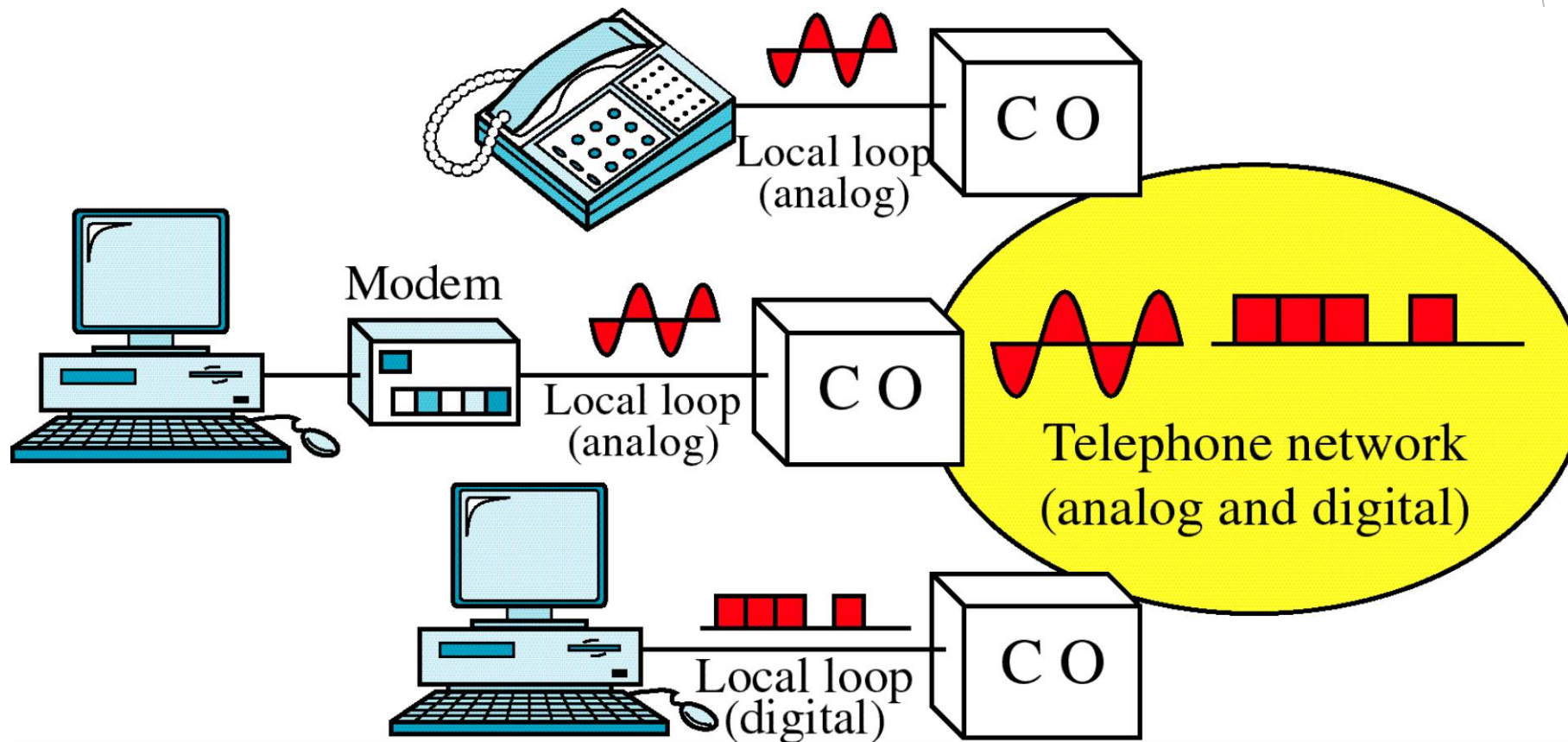




# Voice and Data over Analog Network

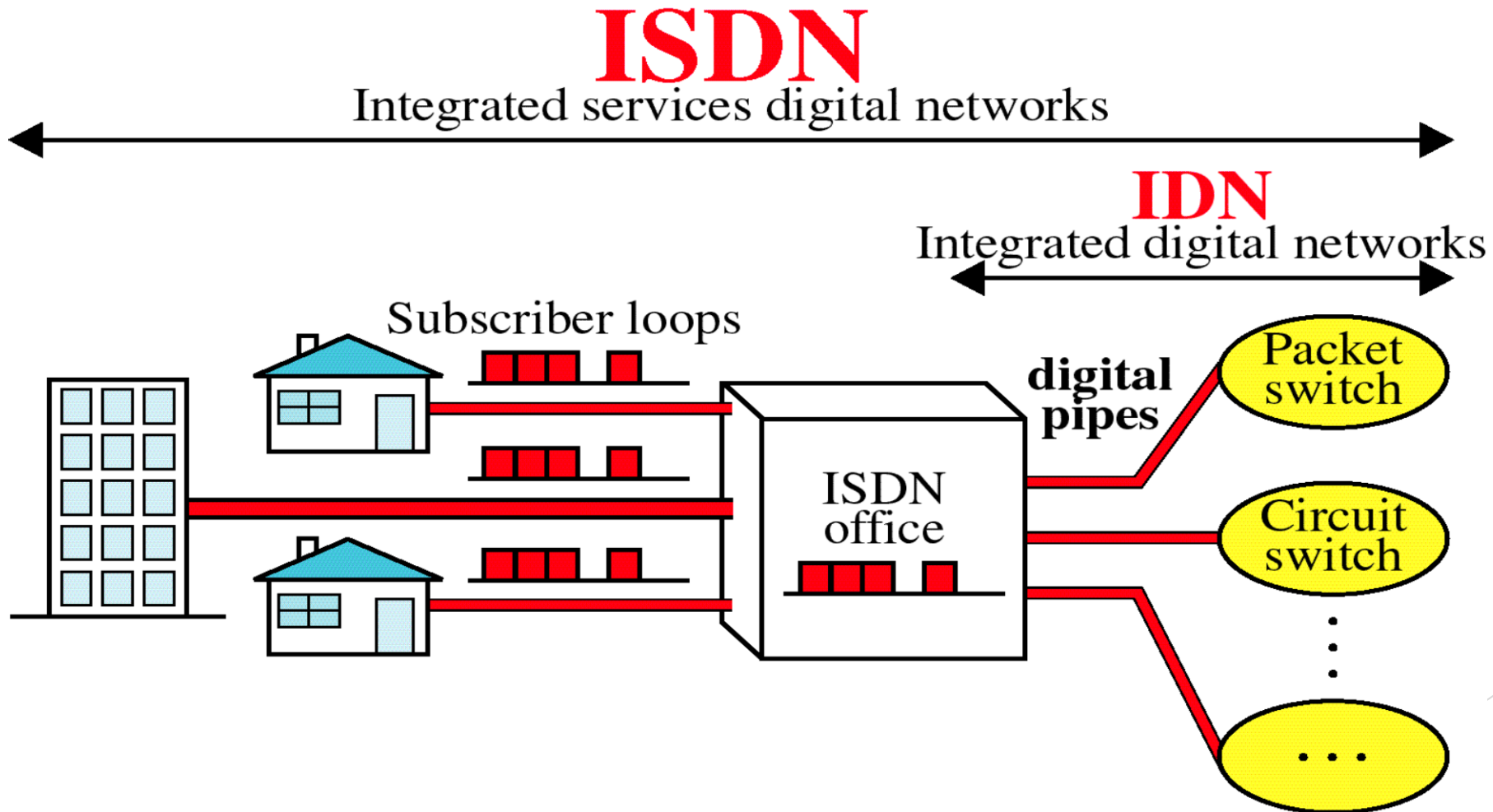


# Analog and Digital Services

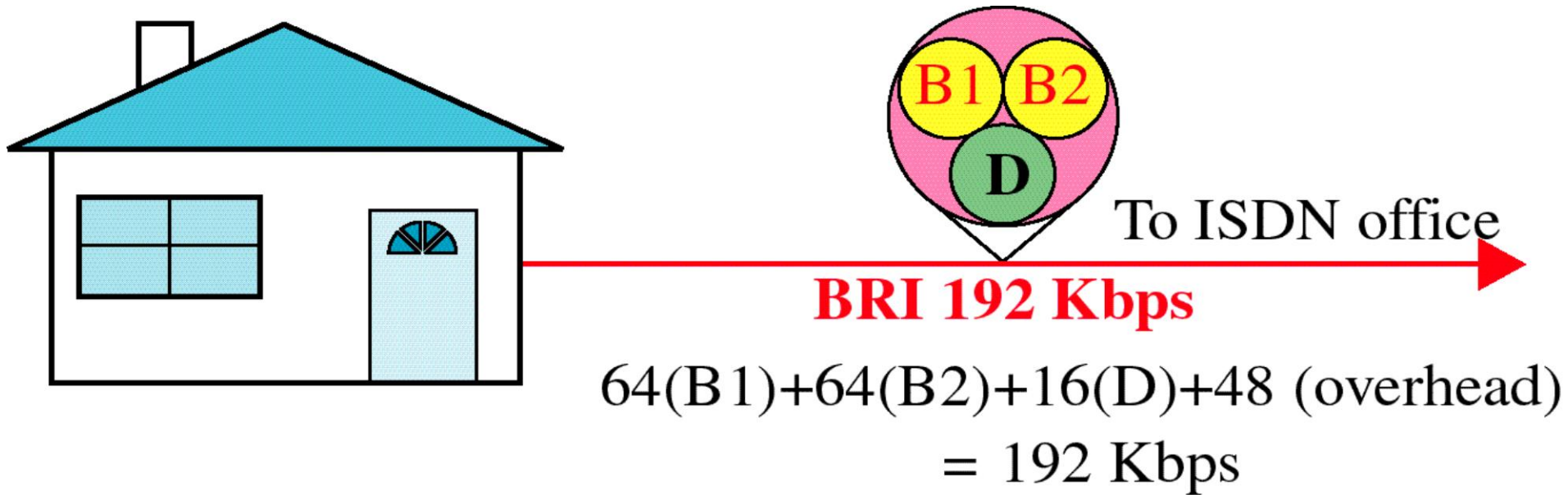




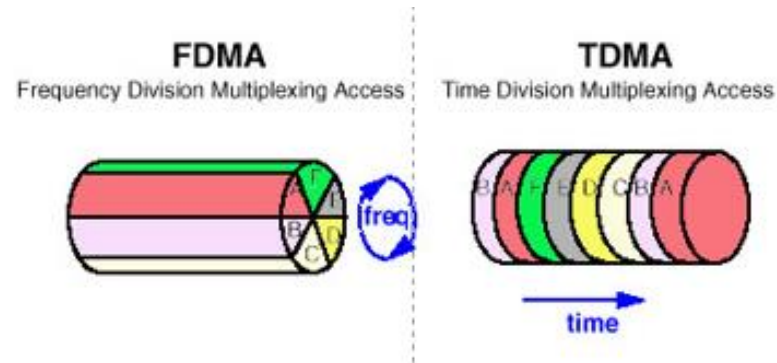
# Integrated Services Digital Network



# Basic Rate Interface

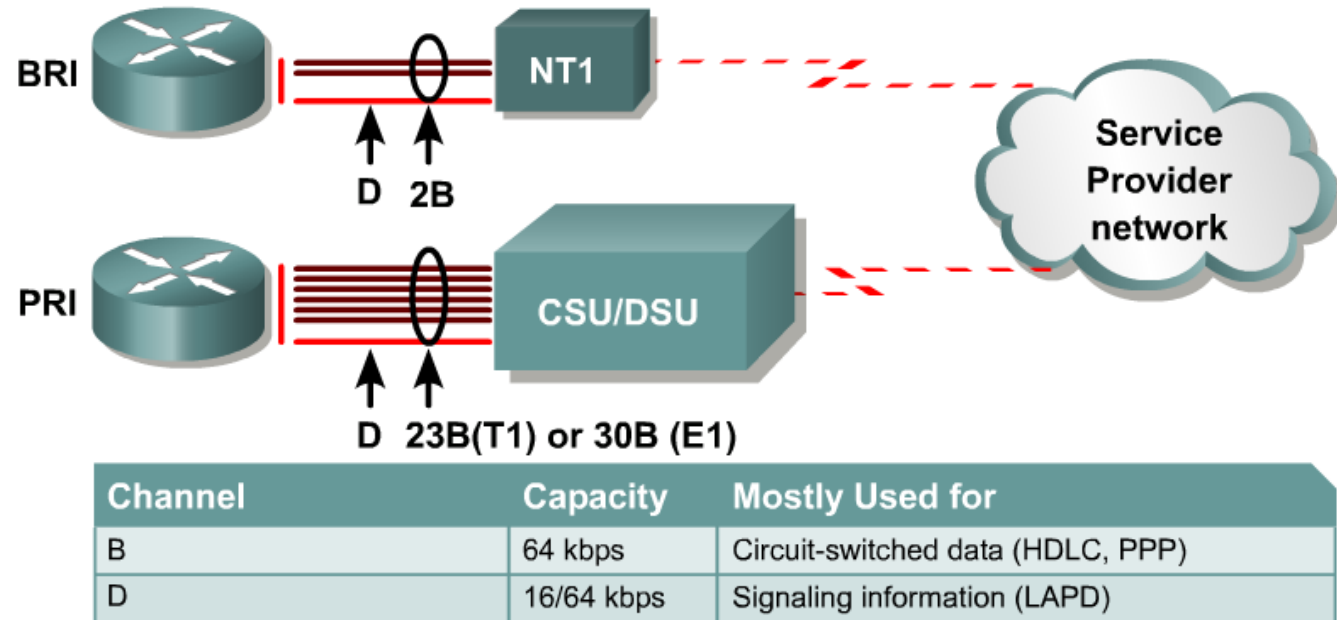


# ISDN Advantages



- ▶ ISDN also provides more bandwidth than a traditional 56 kbps dialup connection.
- ▶ ISDN uses **bearer channels**, also called **B channels**, as clear data paths.
- ▶ Each B channel provides 64 kbps of bandwidth.
- ▶ An ISDN connection with two B channels would provide a total usable bandwidth of 128 kbps.
- ▶ Each ISDN B channel can make a separate serial connection to any other site in the ISDN network.
- ▶ ISDN lines can be used in conjunction with PPP encapsulation.

# ISDN standards and access methods



ISDN standards define **two main channel types**

- ▶ The bearer channel, or B channel, is defined as a clear digital path of 64 kbps
- ▶ The second channel type is called a delta channel, or D channel.
  - ▶ There can either be 16 kbps for the Basic Rate Interface (BRI) or 64 kbps for the Primary Rate Interface (PRI).

# ISDN standards and access methods

- ▶ ISDN is widely available in two flavors:
  - ▶ **BRI: Basic Rate Interface**
    - ▶ 2 64 Kbps Bearer Channels, 16 Kbps Delta Channel (for control information), 48 Kbps for framing and synchronization
    - ▶ 2B + 1D (2B+D)
    - ▶ 192 Kbps = 128+16+48
  - ▶ **PRI: Primary Rate Interface**
    - ▶ 23B + 1D (T1), the D channel is 64-kbps
    - ▶ 30B + 1D (E1), European E1
    - ▶ 1.544 Mbps (North America) or 2.048 Mbps (E1)



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