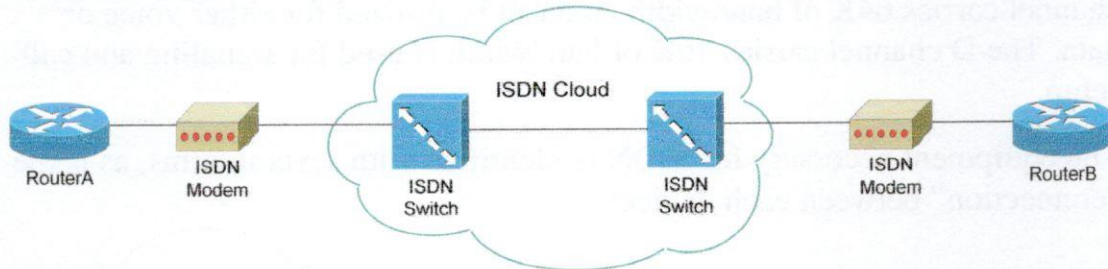


## - Integrated Services Digital Network -

### ISDN (Integrated Services Digital Network)



ISDN is a circuit-switched digital service that can transmit voice and data over existing phone lines. It has faster call setup and bandwidth rates than dial-up connections, and is often utilized as a backup line to a more expensive dedicated leased line.

Like Frame-Relay, ISDN has layer-2 “switches” that control traffic inside the ISDN cloud. There are multiple ISDN switch-types.

The cost of ISDN is based on the number of calls made, and the duration of those calls. Thus, it is not advantageous to have the ISDN connection always active, nor do you want ISDN calls made every few seconds.

There are two types of ISDN:

- **Basic Rate Interface (BRI)** - contains two “B” channels, and one “D” channel. The two **B channels** carry 64K of bandwidth each, and are dedicated for data or voice traffic. The single **D channel** carries 16K of bandwidth, and is dedicated for signaling and call-setup. The total bandwidth for ISDN BRI is 144K (64K+64K+16K).
- **Primary Rate Interface (PRI)** - contains twenty-three “B” channels, and one “D” channel. The twenty-three **B channels** carry 64K of bandwidth each, and are dedicated for data or voice traffic. The single **D channel** carries 64K of bandwidth, and is dedicated for signaling and call-setup. The total bandwidth for ISDN PRI is 1.544Mbs (23x64K+64K).

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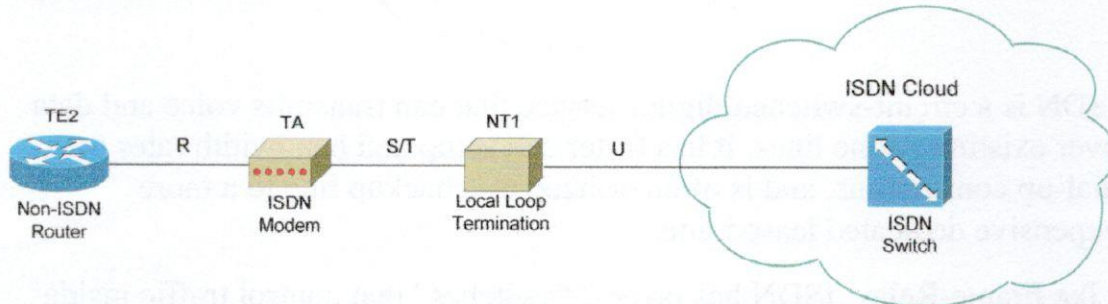
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### ISDN BRI Fundamentals

BRI is (by far) the most common installation of ISDN. As mentioned previously, ISDN BRI contains two **B channels** and one **D channel**. Each B channel carries 64K of bandwidth, and can be utilized for either voice or data. The D channel carries 16K of bandwidth is used for signaling and call-setup.

The equipment necessary for ISDN is identified with several terms, as is the “connection” between each device:

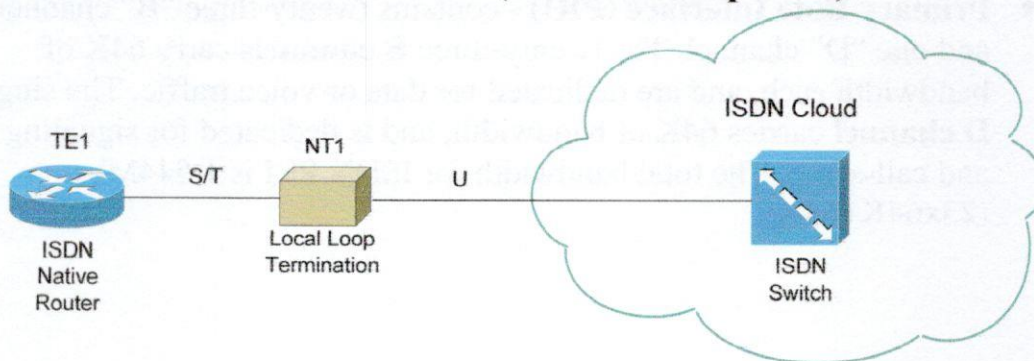


A **TE2 (Terminal Endpoint 2)** identifies a non-ISDN native device (essentially, a device without an ISDN BRI port). This could be a router or workstation that does not support ISDN natively.

To connect a TE2 device to an ISDN network, we need a **TA (Terminal Adapter)**. This is often referred to as the ISDN modem, though it does not technically modulate or demodulate a signal. The purpose of a TA is to provide the BRI interface for a non-ISDN device.

The **NT1 (Network Termination 1)** terminates the local loop from the ISDN Central Office (CO).

ISDN-native devices have the TA integrated (built-in BRI port). An ISDN native device is identified as a **TE1 (Terminal Endpoint 1)**:

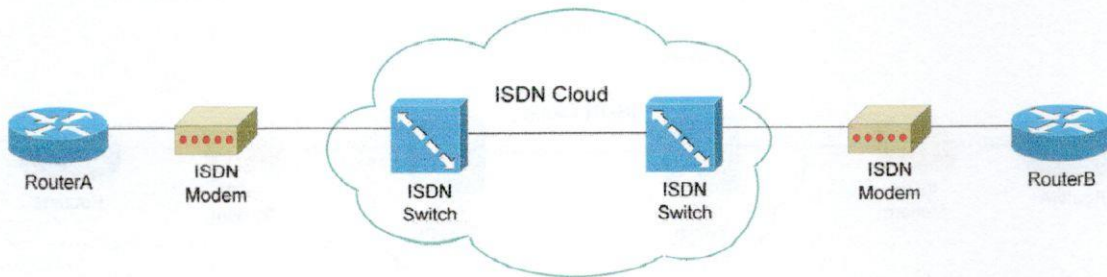


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## ISDN BRI Layers



ISDN employs three layers to its communication process.

**Layer 1** is concerned with the physical ISDN connection. The ISDN BRI connection eventually connects to an **ISDN Switch** at the CO. There are several types of ISDN switches used in the United States, including:

- Basic-5ess
- Basic-dms100
- Basic-ni1

Various alternate switch types exist in other countries. Your ISDN provider will identify which switch type is being used.

**Layer 2** utilizes two protocols on the D Channel, **Q.920** and **Q.921**, to provide the physical layer addressing for ISDN. TE1's (or TE2's + TA's) are physically identified using a **TEI (Terminal Endpoint Identifier)**:

- Static TEI's are numbered 0 – 63
- Dynamically assigned TEI's are numbered 64-126

The connection is then logically identified using **SAPI's (Service Access Point Identifiers)**.

**SPIDs (Service Profile Identifiers)** are also a component of Layer 2 (only BRI uses SPIDs, PRI does not). SPIDs identify two things:

- The phone number of each B channel
- The ISDN services you are entitled to.

Not all ISDN switch types require the use of SPIDs.

On the B channels, one of several Layer 2 encapsulations can be used, including HDLC, PPP, and Frame-Relay.

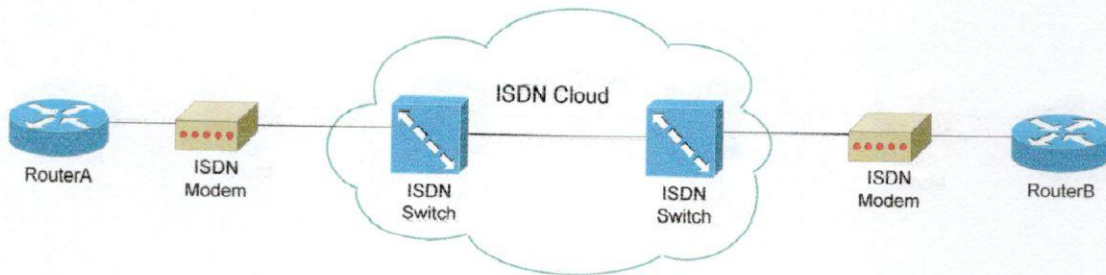
**Layer 3** utilizes just one protocol on the D Channel, **Q.931**, which controls call setup and teardown.

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## Configuring Basic ISDN BRI



Cisco routers that support ISDN will have BRI interfaces, or utilize serial interfaces for PRI connections. This guide will cover only the configuration of ISDN BRI.

The first thing that must be configured for ISDN is the *switch-type*, which can be configured either on the interface or in Global Configuration mode. The ISDN provider will indicate which ISDN switch-type is used:

```
Router(config)# isdn switch-type basic-ni
```

Other basic configuration is completed on the BRI interface:

```
Router(config)# int bri0/0
Router(config-if)# encapsulation ppp
Router(config-if)# ip address 172.16.1.1 255.255.0.0
Router(config-if)# isdn spid1 055512120100 5551212
Router(config-if)# isdn spid2 055512130100 5551213
Router(config-if)# dialer string 5552222
Router(config-if)# no shut
```

PPP is the most common encapsulation for ISDN.

The *isdn spid1* and *isdn spid2* commands identify the two B channels to the ISDN switch, and are assigned by the ISDN provider. SPIDs identify the phone number and expected services for each B Channel. Not all ISDN switch-types require SPID numbers.

The *dialer string* command contains the phone number of the remote router. This is the number that is “dialed” when the router is activating the ISDN connection.

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