

Chapter 6

Telecommunications, the Internet, and Wireless Technology

LEARNING TRACK 2: BROADBAND NETWORK SERVICES AND TECHNOLOGIES

A number of network services and technologies are available to companies that need high-speed transmission or access to the Internet.

Frame relay is a shared network service that is faster and less expensive than packet switching and can achieve transmission speeds ranging from 56 Kbps to more than 40 Mbps. Frame relay packages data into frames similar to packets but takes advantage of higher-speed, more reliable digital circuits that require less error checking than packet switching. The major telecommunications carriers provide frame relay services. Many organizations use frame relay services in their international data communication networks.

A technology called **Asynchronous Transfer Mode (ATM)** can handle many types of network traffic and provides transmission speeds ranging from 1.5 Mbps to more than 9 Gbps. Like frame relay, ATM takes advantage of high-bandwidth digital circuits, parceling information into fixed 53-byte cells, of which 48 bytes are for data and 5 are for header information. ATM can pass data among computers from different vendors and is popular for transmitting data, video, and audio over the same network. Many telecommunications carriers and large enterprise backbone networks use ATM.

Integrated Services Digital Network (ISDN) is an older, international telephone standard for network access that integrates voice, data, image, and video services. It is still very effective for supporting interactive teleconferencing over long distances (say New York to São Paulo, Brazil). There are two levels of ISDN service: basic rate ISDN (which can transmit at 128 Kbps) and primary rate ISDN (which can transmit at 1.5 Mbps).

Other high-capacity services include digital subscriber line technologies, cable, and T1 lines. Like ISDN, **digital subscriber line (DSL)** technologies also operate over existing telephone lines to carry voice, data, and video, but they have higher transmission capacities than ISDN. (By 2005, most small businesses had converted from ISDN to either cable or DSL Internet services, which are cheaper and more powerful.) There are several categories of DSL. Asymmetric digital subscriber lines (ADSLs) support a transmission rate of 1.5 to 9 Mbps when receiving data and over 700 Kbps when sending data. Symmetric digital subscriber lines (SDSLs) support the same transmission rate for sending and receiving data of up to 3 Mbps.

Cable Internet connections provided by cable television vendors use digital cable coaxial lines to deliver high-speed Internet access to homes and businesses. They can provide high-speed access to the Internet of up to 10 Mbps. More than 60 percent of U.S. broadband households use cable (eMarketer, 2005b) as opposed to DSL telephone Internet service.

Both Cable and telephone Internet providers are gearing up for the day when the Internet becomes the primary distribution channel for video. Not

just YouTube videos, but feature length Hollywood and Bollywood movies. These "bandwidth hogs" will require very fat pipes into homes and businesses.

The providers of DSL service like Verizon and AT&T are greatly expanding their broadband services by re-wiring entire communities with fiber optic cable and bringing it either to the curb or into the house or business itself. Verizon's fiber service is called FiOS and can deliver up to 50 Mbps (5 times faster than its fastest DSL offering). AT&T's U-verse can offer up to 10 Mbps.

Not to be out done, the Cable companies are responding with their own unique technologies. Comcast and Time Warner (the two largest cable providers in the United States) are developing a new technology called Docsis which can deliver 50 Mbps speeds to the end user. Docsis uses technology called "channel bonding" where several smaller cable channels are linked together to create a single pipe with a much larger capacity than could be obtained by just adding up the capacities of the individual lines. It is relatively cheap but labor intensive to build. It does not require any re-wiring of communities unlike the telephone systems.

But what if you have large amounts of very sensitive information to send out from one continent to another? Would you use the Internet, or a public telephone service? Chances are you would not use either because the risk of failure or security losses is too great. The Internet does not guarantee any level of service, just "best effort." Most Fortune 1000 Firms that have large amounts of data to move across the continent, or around the world, or that have high-security or guaranteed service level requirements, lease high-speed data lines from communication providers, typically long-distance telephone companies. These lines are designated as **T lines**.

T1 lines offer up to twenty-four 64-Kbps channels that can support a total data transmission rate of 1.544 Mbps. Each of these 64-Kbps channels can be configured to carry voice or data traffic. A T3 line is a very high-speed connection capable of transmitting data at a whopping rate of 45 million bps. You will rarely encounter a T3 line unless you work in the networking department of a major corporation or university. For instance, the Internet backbone operates using multiple T3 lines. Leasing a T1 line costs about \$1,000 per month, whereas T3 line costs start around \$10,000 per month. Table 6-1 summarizes these network services.

TABLE 6-1 BROADBAND NETWORK SERVICES

SERVICE	DESCRIPTION	BANDWIDTH
Frame relay	Packages data into frames for high-speed transmission over reliable circuits that require less error-checking than packet switching	56 Kbps to 40+ Mbps
Asynchronous Transfer Mode (ATM)	Parcels data into uniform 53-byte cells for high-speed transmission; can transmit data, video, and audio over the same network	1.5 Mbps to 9+ Gbps
Integrated Services Digital Network (ISDN)	Dial-up network access standard that can integrate voice, data, and video services	Basic rate ISDN: 128 Kbps Primary rate ISDN: 1.5 Mbps
Digital subscriber (DSL)	Dial-up network access standard band Internet access	ADSL: Up to 9 Mbps for receiving and over 700 Kbps for sending data
FiOS U-verse	Fiber optic service to the curb or modem in house or business	50 Mbps standard service (U-verse: 10 Mbps)
Cable Internet connection	Dedicated cable network broadband access	Up to 10 Mbps
Docsis	Channel bonding technology that multiplies the power of individual cable channels	50 Mbps standard service
T-lines	Dedicated lines for high-speed data transmission and Internet connection	T1: 1.544 Mbps T3: 45 Mbps