Chapter 4 - The Internet and Telecommunications

Digital Information Channels (Bandwidth) and Connectors

Transmitting digital data requires a connector to a wire, or wireless *pipeline,* that will carry video and other data from one location to another. In most cases, this is done by wire, radio, or space satellite.

The *key* to transmission of data is the pipeline width and the decoder devices or connectors on each end of the connection.

The pipeline or bandwidth of the cabling or wireless transmission, along with the connectors, determines the speed that data that can be transmitted. On each end of the pipeline, there are connectors, such as modems, that compress and decompress the digital data for the user. If you have unlimited pipeline width then the decoder devices to compress information are unimportant. On the other hand, if you have a finite pipeline width, then the connectors and compression and decompression techniques become important. The eventual goal is to carry four signals at once: telephone, television, radio, and computer digital information.

Web access at high speeds is still the province of cable, DSL, and the new wireless broadband connection. It is projected that over 8,000,000 households will be connected to a high speed cable modem, 5,000,000 to DSL, and 500,000 to a wireless broadband connection by the year 2003. Wireless broadband requires LMDS (local multipoint distribution system) that requires nearby antennas to relay the signal. The infrastructure needs to be built on these systems for wireless to make it to prime time.

With the recent deregulation of the communication industry, we now have numerous hard wire suppliers. These include our local telephone companies, cable companies, Competitive Access Providers (CAPS), Internet Service Providers, and regional bell operating companies, among others.

The following are various methods of carrying digital data over different types of “pipelines” or connections. Also included is the required bandwidth to transmit different types of digital information. Other than satellite, the following connectors are all cable or “hard wire” connections.

Channel Type	Bandwidth Size	Bandwidth Required for Da
Cellular Phones	19.2 KBPS (basic)	
POTS (Plain old telephone line)		
33 KBPS, 56KBPS with 2X		
JPEG - images full screen - 20	KBPS	
ISDN (switched 56)		
56 KBPS +		
Wireless Cellular packet		
128 KBPS +		
Fractal T-1		
112 KBPS +		

Video MPEG-1 video quality requires a 120 to 140 KBPS data stream. VHS quality at

Twisted pair - 1 base 3

1 MBPS +

Video MPEG-2 quality, quarter screen full motion requires 500 KBPS.

Video MPEG-2 quality full screen & full motion requires 1 MBPS, SVHS quality.

Satellite (wireless)

1 MBPS +

T-1

1.54 MBPS +

Cable Television

1 MBPS +

Token ring

10 MBPS +

Switched Ethernet

10 MBPS +

Coaxial - 10 base 2

10 MBPS +

Twisted pair - 10 base T

10 MBPS +

T-3 and DS-3

45 MBPS +

Fast Ethernet

100 MBPS +

FDDI

100 MBPS +

OC-1

115 MBPS +

ATM - 155

1.26 GBPS +

* KBPS - Kilo bits per second - 10 KBPS means that data is transmitted at 10,000 bits per second.
* MBPS - Million bits per second - 1 MBPS means that data is transmitted at 1, 000,000 bits per second.
* GBPS - Gigabytes per second - 1 GBPS means that data is transmitted at 1,000,000,000 bits per second.

Time to Download a One Megabyte File (Estimates - I

Type of Channel	14,400 BPS telephone	128,000 BPS ISDN	Coaxial 10,000 KBPS or 10 MBPS
Time	9.7 minutes	66 seconds	.8 seconds
Cost	$20 + per month		

$45+ per month

$49+

Usage

98%

6.7 million homes by 2000

6.9 million homes by 2000

POTS (Plain Old Telephone Lines). One of the most used pipeline was the regular analog copper telephone line. For a regular analog phone line, the rate of transmission is approximately 1,200 baud or 1,200 BPS. This is a measurement of how fast information is transferred. BPS refers to bits per second. Connectors, such as modems, are available to increase the transmission over a phone line at a higher rate, such as 2,400; 4,800; 9,600; 14,000; 28,800; 33,600, or 56,000 bits per second. The modem encodes the data for faster transmission before sending it over the phone line and the receiver decodes it on the other end. If both parties have 28,800 modems then, the faster transmission is available. However, if one party has a 14,000 modem, then the other party will receive the information at that rate. Also, be aware that DSL lines discussed in the next part will transmit data at a much higher rate over POTS lines once the digitizing of the lines takes place.

ISDN Lines. Many phone companies are digitizing existing analog telephone lines, which are then called ISDN lines, and which create a larger pipeline to send data. The normal phone line with a 28,000 modem can send and receive data at 28,800 bits per second. A phone line that has been digitized can send and receive information at four times that amount; 128,000 baud or

128,000 bits per second. ISDN lines can also be leased that transmit at 56,000 BPS rate and above.

Fractal T-1 and T-1 Lines. These lines are hardwired and offer a bandwidth ranging from 112, 000 BPS to over 1,000,000 BPS. Phone companies and others are offering T-1 connections that can transmit data at 1.54 MBPS. The competition for your connection is becoming increasingly competitive with CAPS (competitive access providers), offering full T-1 connections for as low as $300 per month.

Token ring, switched Ethernet, Coaxial - 10 base 2, Twisted pair - 10 base T , etc. These computer networking wire connections operate generally at 10,000,000 BPS. The transmission of digital information within a LAN, such as text, images, and video conferencing, is as important as connecting to clients across the country.

Cable TV Connection. Cable TV (CATV) companies offer Internet access to its cable customers through existing cable. They offer bandwidth at 1.5 MBAs or higher access rates, which are over 30 times the current 56,000 BPS offered through regular phone lines. The increased bandwidth will enable an array of multimedia applications, including full motion video, sound, graphics, and so forth. The availability, pricing for the service, and the cost of a cable modem depends on the part of the country in which one resides. Existing systems need to be upgraded and since different customers share the same cable, the speeds will decrease as more users transmit on the same connection.

Fiber Optics. Fiber Optics uses light instead of electrical impulses to carry the signal. Fiber optics is commonly used in selected parts of networking, and fiber optics lines have been laid across our country. An optical filter is a hair-thin strand of glass. In communication, it will carry four types of information at once: telephone, television, radio, and computer data. Fiber optics is one of the keys to transmitting much greater amounts of digital information over "hard wire". The increased efficiency and capacity to transmit data will enable "multimedia applications" to be sent and received. Multimedia includes text, sound, graphics, and video. Interactivity will become a product of fiber optic. Fiber optics' signal strength enables a signal to be run a long distance without a weakening of the signal. Because of its signal strength, data speeds can increase from 10M (10,000,000 bits per second) to over 1G (1,000,000,000 bits per second), which will be sufficient for future network data needs.

[illegible] rate digital subscriber line)