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Broadband Telecommunications Technologies for Connecting to the Internet —Ignore Them at Your Peril !

Presented by: Proprietary Rights Committee, Computer Law Section, State Bar of Michigan
Written by: Chairman, David R. Syrowik

Contents

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The President's Information Technology Advisory Committee stated almost five years ago that: "Information Technology will be one of the key factors driving progress in the 21st Century – it will transform the way we live, learn, work and play. Advances in computing and communications technology will create a new infrastructure for business, scientific research and social interaction. This expanding infrastructure will provide us with new tools for communicating throughout the world and for acquiring knowledge and insight from information." Since this statement was made, the telecommunication industry has experienced a crash from which it is still picking itself up. The goods news is that much of the expensive optical transmission equipment including optical fiber is in place to provide services as they become economically feasible.

As you may know, the Computer Law Section has recently revised its bylaws to make it clear that "The purposes of the Section are to review, comment upon and apprise members of the State Bar of Michigan and others of developments in the law relating to information technology."

While many might initially think that "Information Technology" broadly means "technology relating to information," a better answer to the question "What is Information Technology?" might be "the combination of telecommunications and computing to obtain, process, store, transmit and output information in the form of voice, pictures, words and numbers."

The continuing convergence of computing and communications has come about in large part by the fact that most, if not all, information such as voice and data can be encoded into digital signals so these signals can be handled, not only by computers, but also by modern telecommunication networks.

Except for the Internet, telecommunications services such as existing telephone networks are still subject to heavy Federal and State control

and regulation despite the fact that the Telecommunications Act of 1996 (Pub.L. 104-104) was designed to "reduce regulation and encourage the rapid development of new telecommunications technologies."

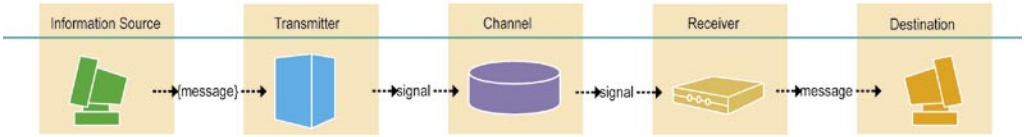
In a survey of e-commerce contained within the May 15, 2004 issue of *The Economist*, the rise in e-commerce was largely attributable to the corresponding rise in high-speed Internet connections. It was found that such high-speed connections encourage users to do more things on-line, such as on-line shopping, because the connections are faster and provide more convenience.

A clear, accurate and detailed understanding of broadband telecommunication technologies is essential to proper legal analysis in this important area. In fact, some have taken the position that lawyers who do not understand such technology will almost certainly struggle and may ultimately fail in their legal practice.[1]

This report primarily provides an overview of some basic technical considerations for telecommunications technology as they relate to the Internet. A number of business and legal considerations are also provided for each discussed telecommunication model. In Section II of this report, a simplified, one-way telecommunications model is provided as a basis for the models discussed in subsequent sections. Then, a number of high-speed telecommunications models for Internet access are discussed in Sections III-VI. Finally, a number of telecommunication/information technology trends are identified in Section VII.

II. Simplified, One-way, Telecommunication Model

SIMPLIFIED, ONE-WAY, TELECOMMUNICATION MODEL



Technical Considerations

An information source or provider generates a message. The message or content may include computer programs, audio (including voice), video, graphics, data and text. The message may be digitized so it can be stored, transmitted, etc. by computers. The message is transmitted by a transmitter as a signal over a channel after coding or modulation within the transmitter. The received signal includes noise introduced during travel of the signal over the channel.

As discussed later in this report, the main competing high-speed or broadband (high-speed does not necessarily mean broadband) Internet access technologies for end users currently include cable, telephone (i.e., DSL) and wireless. A channel may be either a one-way or two-way path providing communication in either one direction only or in two directions over the channel. Here, "channel" refers to the physical medium, such as cable, telephone and power lines, or non-physical medium (e.g., the atmosphere or space) through which signals propagate. Typically, a medium can be divided into multiple channels or paths, either by frequency or time

division or coding to enable multiple types of signals to be transmitted over the same medium. An example is television signals and data signals, which can travel over the same coaxial cable.

The message collected by the receiver is forwarded to a destination after being decoded or demodulated within the receiver. The destination may be combined with the receiver to form an information appliance, such as a portable or hand-held computer, a "smart" wireless telephone, a television set-top box or a game console. After receipt by the destination, the message can be utilized or re-transmitted as a signal to another receiver.

The above model is modified for the high-speed Internet technologies or models described herein to show two-way communication wherein messages and signals flow in both directions over the channel between the information source and the destination. In such two-way communication, the destination also becomes an information source and the information source also becomes a destination.

In a two-way telecommunication system, both the transmitter and the receiver might be replaced by a transceiver (transmitter/receiver) which is a combination of a transmitter and a receiver in a single package.

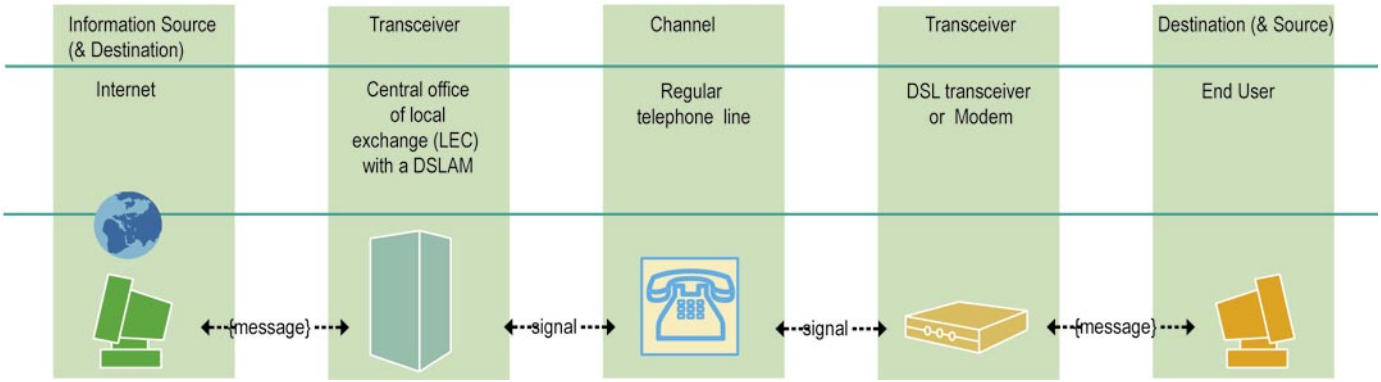
Business Considerations

One of the primary points of this report is to illustrate the battle among telecommunications companies for the "last mile" of infrastructure access to the customer's premises. These companies believe that the one who wins that battle is the company that will be the ultimate provider for all of the customer's telecommunications needs, including both local and long distance telephone service, broadband Internet service, and video/cable service. In other words, the company that controls broadband access is the company most likely to control all telecommunications access.

Legal Considerations

The regulatory picture is complicated by the emergence of multiple competing high-speed Internet access techniques such as fixed wireless, mobile wireless, satellite, cable modem, and DSL. As the number of competing technologies increases, the arguments for government intervention must be reexamined. Meanwhile, the various communications companies and Internet service providers have continued to litigate, trying to improve their position at the expense of their competitors.

TELEPHONE (i.e. DSL) TWO-WAY MODEL



III. Telephone (i.e. DSL) Two-way Model

Technical Considerations

Telephone technology has historically used "circuit switching," wherein, when a telephone call is placed, telephone company equipment sets up an electrical path over a Public Switched Telephone Network (PSTN) from the calling party to the called party. The entire conversation then flows over this path, which is inherently two-way. There is a long history of data transfer over PSTN, which tends to be quite secure.

This report is not concerned with the equipment provided by the Internet Service Provider (ISP) (and perhaps others) located between the Internet and the transmitter. Consequently, the line carrying the message between the information source (i.e., Internet) and the transmitter is broken. Again, this line carries messages in both directions. Rather, the focus of this report is

on the "last mile" of infrastructure access to the end user's destination premises. Here, this "last mile" is called a "local loop" which extends from the central office in a particular locality to customers' phones at homes and businesses.

Digital Subscriber Line, or DSL, uses existing telephone lines already in place to virtually every home and business for many years. The telephone line carries information over a series of copper wires. To distinguish the various flavors of DSL, the term "xDSL" is used, with "x" representing the form of DSL. Asymmetric DSL, or ADSL is by far the most common form of DSL in use today. Other forms of DSL will be addressed briefly at the end of this column.

The capacity of a telephone line is measured in terms of Hertz, or Cycles Per Second. For practical purposes, most telephone lines have a capacity (or bandwidth) of 1.5 million Hertz (1.5 Megahertz). Of this capacity, only about four KHz are used for customary voice communications. Voice communications therefore occupy only a tiny portion of the entire capacity available on the average telephone line. At one time, this was probably viewed as wasteful. The extra capacity, however, was eventually recognized as a ready made vehicle for carrying information to and from the Internet at a very high rate of speed.

As with all methods of broadband communication, the power of DSLis measured in terms of speed. Although once considered state-of-the-art, our fast paced lives are frustrated by the comparative slow speeds of conventional dial-up modems. ADSL designers realized that the Internet access required by most users places a much greater emphasis on downloading information into their computers than on uploading information from computers to the Internet. A greater portion of the telephone line is therefore dedicated to downloading than to uploading. At a distance of 6000 feet, ADSL can provide a maximum download speed of 8 Megabits Per Second (Mbps), with an uploading speed of only .64 Mbps. This introduces an additional factor to the DSL equation, distance. One of the main drawbacks of ADSL is that a user's connection functions properly only when it is no more than 18,000 feet from an internet provider's office. Within this distance, the further a household or business is from the central office, the more the access speed is impaired.

One may find ADSL's distance limitations perplexing. We have, after all, been using our standard telephone lines to communicate world-wide for many years. Why are these lines now so limited? Voice signals are boosted by small amplifiers called loading coils. Loading coils are, however, not compatible with ADSL signals. Other factors that make distance a major limitation to ADSL are bridge taps and fiber-optic cables. Bridge taps are extensions between the user and the central office that extend services to other customers. While they are not noticeable in standard voice communications, they reduce the effectiveness of ADSL. Fiber-optic cables limit the effectiveness of ADSL because ADSL signals cannot pass through the conversion from analog to digital and back that is inherent in fiber-optic technology.

There are two forms of ADSL. The older, less sophisticated form is the carrierless amplitude/phase (CAP). The new, higher tech version of ADSL is discrete multitone (DMT). DMT is the officially recognized ANSI standard for ADSL. CAP operates in a relatively straightforward, albeit less efficient manner than DMT. The telephone line's copper wire capacity of approximately 1.5 MHz is simply divided into sections for use in meeting its various requirements. The miniscule 4 KHz required for voice communications occupies the first portion, the capacity. The next usable portion, between the 25 and 160 KHz bounds of the telephone line is dedicated to the user's uploading requirements. The remainder of the approximately 1.5 MHz capacity is dedicated to information downloading. The greatest capacity of the available bandwidth is therefore used to download information to one's computer. This is how communication engineers have been able to meet the most highly demanded requirement, fast downloading, as discussed earlier.

DMT divides the available bandwidth into 247 separate channels of four KHz each. The 247 individual channels have the advantage of being accessible in many combinations, as needed. As signal quality is impaired or overused on one channel or set of channels, signals are shifted to alternative channels. In this way quality can be adjusted as necessary. With both CAP and DMT, data transmission is kept from interfering with voice communications by a low-pass filter that is installed between the telephone jack and the telephone.

Two significant pieces of equipment are used to complete the ADSL connection. A DSL Transceiver, sometimes referred to as the DSL Modem is installed

at the user's location to ready data for transmission into the system, and for use after receipt from the system. The central office makes data ready for use by the Internet with the use of a DSL Access Multiplexer (DSLAM). The DSLAM provides one of the major advantages of ADLS over the cable modem. Cable modems share a loop of cable that runs through the user's neighborhood. As additional users are added to the loop, quality is impaired. ADSL, however, sends a dedicated signal for each user back to the DSLAM.

As stated earlier, there are other less common, yet efficient forms of xDSL available on a limited basis. Very High Bit-Rate DSL (VDSL) provides an extremely fast connection, but works only over a short distance. The 8 Mbps download speed provided by ADSL is increased to up to 52 Mbsp with VDSL. We have already discussed the significant distance limitations of ADSL. These limitations are greater with VDSL, which is limited to a distance of about 4,000 feet between the user and the central office. However, the limitations of ADSL in its use with fiber optics discussed earlier are overcome by VDSL, which uses various fairly recent innovations, such as Fiber to the Curb (FTTC) and Fiber to the Neighborhood (FTTN). These technologies when combined with a VDSL Transceiver Gateway at the telephone junction box overcome the translation problems.

Several other forms of xDSL are also available, such as HDSL and RDSL. These varieties provide advantages, and are limited by disadvantages when compared with ADSL. Some are less acceptable only because the technologies remain in their infancies. Others are limited because they required extra phone support, thus negating one of the principal advantages of DSL. The main advantage of these technologies is greater speed.

Wireless DSL has provided users with access to broadband technology where conventional digital subscriber lines and digital cable are not available, as well as to those users who simply choose to "go wireless." Here, a base station, often located on top of a cellular tower or other high location connects a user to a PSTN by way of a terminal located on the user's premises. To provide access to wireless DSL both now and in the future, many providers are now building the required functionality into the equipment installed on the customer's premises.

Business Considerations

DSL technology is currently one of the dominant means of providing broadband Internet access to end users worldwide. This technology piggybacks on existing PSTN telephone technology and provides links for approximately ten million people in the United States.

ADSL, as with all forms of broadband communication, has advantages and disadvantages. Some of these have already been discussed. Speed is a major advantage over the standard dial-up modem, as is the ready made link to the Internet provided by the standard copper wire telephone line. In addition, voice communications do not need to be discontinued when an ADSL connection is opened. As already addressed however, ADSL has limitations. Distance between the user and the central office limits the technology's effectiveness. Because a far greater portion of ADSL bandwidth is dedicated to downloading data, there is less bandwidth and thus slower speeds available for uploading.

Legal Considerations

Regulatory agencies such as the FCC and/or the courts sometimes force telephone companies to lease or resell their fixed-lines, i.e., local telephone "loops," and their DSL equipment to competitors to provide DSL service while the telephone company provides voiceband service. This is called "line sharing." This has caused a lot of controversy and had caused America to lack a coherent broadband policy since there is little incentive for the telephone companies to expand their existing networks if such expansions must be leased to others at low rates. Ironically, the Telecommunications Act of 1996 was designed to promote competition and reduce regulation in order to encourage "the rapid deployment of new telecommunications technologies."

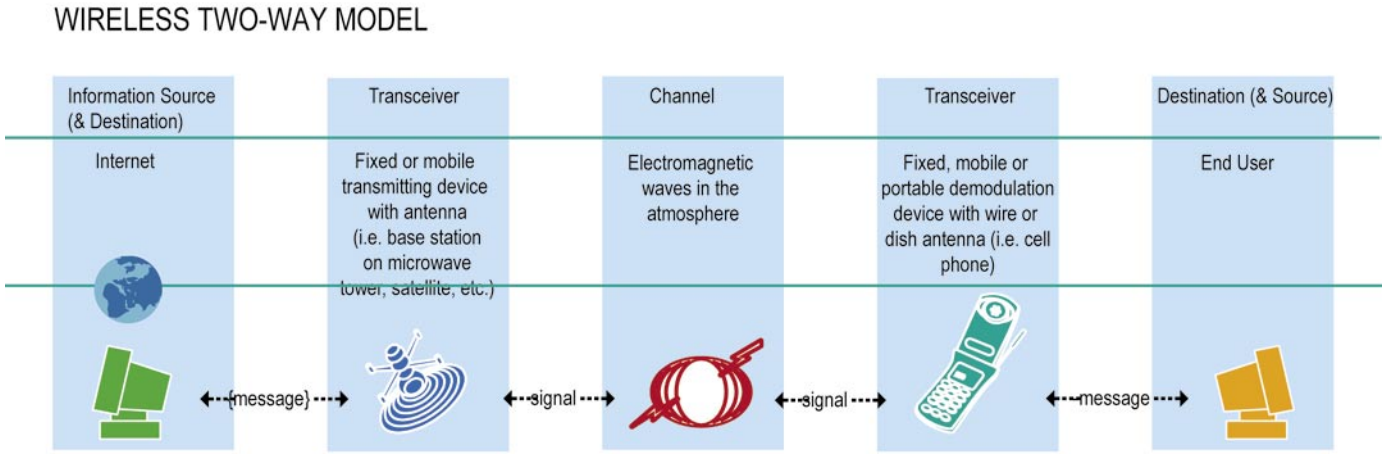
As reported at 2004 WL 374262, the U.S. Court of Appeals for the District of Columbia on March 2, 2004 rejected Federal Communication Commission (FCC) rules that force the Baby Bells to open their phone networks to rivals at regulated prices. Also, the court struck down as unreasonable the agency's February, 2002 decision to give the 50 states the responsibility for determining which parts of a local phone network should be available to rivals at relatively low prices. The court chastised the agency for failing to develop lawful unbundling rules (how to separate different services over the same channel) since the 1996

Telecommunications Act and for failing to adhere to prior judicial rulings of the courts. *United States Telecom Association v. Federal Communications Commission.*

Also, at the state and local level, right-of-way and zoning issues are important to allow the laying of fiber-optic or new copper lines.

slower communication system such as a regular telephone line is utilized to send messages from the destination back to the original information source.

As clearly reflected by its name, satellite technology requires massive infrastructure. A satellite is a highly specialized wireless receiver/transmitter that is launched by a rocket and placed in orbit around the Earth. There are hundreds of satellites currently in operation. The launching vehicles must be capable of delivering and locating the satellite.



IV. Wireless Two-way Model

Technical Considerations

Wireless systems may have a fixed, portable or mobile transmitter (transceiver for two-way communication) and a fixed, portable or mobile receiver or transceiver. A handheld cellular phone is an example of a digital or analog portable transceiver (operates as a transmitter or receiver). An automotive cell phone is an example of a mobile transceiver. New third generation (i.e., 3G or IMT-2000) networks and their phones support high-speed Internet access.

One kind of fixed transceiver or base station may provide wireless service over a large area. Such a system may be called a "fixed-fixed" system wherein a central antenna of the transceiver is mounted on a large tower such as a radio tower and rooftop antennas on homes or offices are provided as part of their transceivers. A "fixed-portable" system may use such a fixed transceiver and handheld cell phones.

One type of a wireless system includes a mobile transmitter within an orbiting satellite, which may also operate as a receiver (i.e., to form a transceiver) in a two-way system. In such two-way systems, a user's dish antenna also is used to receive and transmit signals to the satellite. In a one-way satellite system, a different,

In addition, much of the hardware and software contained in the satellite is dedicated to the transmission of communication signals. Satellite communication systems differ from terrestrial systems in that the transmitter is not based on the ground. Rather, the transmitter is a ground-based part called the uplink, and the satellite-based part called the transponder relays the signals towards the earth-stationed receivers. Modern satellites can receive and transmit hundreds of signals at the same time, from simple digital data to television broadcasting, amateur radio communications, Internet communications, weather forecasting, and Global Positioning Systems (GPS).

Earth stations include many devices and installations for satellite communications including handheld devices for mobile satellite telephone, briefcase satellite phones, satellite TV reception, very small aperture terminals (VSAT) stations and satellite broadcast TV stations. The term Earth station refers to any of the collection of equipment that is needed to perform communications via satellite including the antenna such as a dish antennas and the associated equipment such as transmitters and integrated receiver/decoders (IRD).

The position maintaining feature of the satellite may be referred to as the bus and the communication function of the satellite may be referred to as the payload. The bus provides electrical power, navigation, control and propulsion to the spacecraft. The bus equipment allows the satellite to communicate a kind of 'remote control'.

The most common type of communications satellites, particularly the broadcast satellites like AfriStar, Intelsat, PanAmSat, Eutelsat and ASTRA, are in geosynchronous orbit. That positions the satellite over one spot on Earth in a position 35,786 km out in space perpendicularly above the equator. Satellites in low earth orbits (LEOs) circle around the Earth at 27,359 km per hour. The orbits take the satellites over the geographic poles. Each revolution takes from less than 90 minutes up to a few hours. The fleet is arranged in such a way that from any point on the surface at any time at least one satellite is in line of sight.

Global coverage requires that the pattern of satellite antenna transmission covers the largest possible portion of the Earth that can be viewed from the satellite. For geostationary satellites, the beam width for global coverage is about 17.4 degrees. No satellite can cover the whole surface of the Earth at one time; to achieve a global coverage, multiple transmission beams from at least 3 different satellites are combined.

To keep the satellite within acceptable margins from its ideal position, 'thrusters' are mounted on the body of the satellite as part of its propulsion system. As long as the satellite has enough fuel left to operate its thrusters, it will not drift out of control and into space, which brings an end to its operational life. The satellite service operator can decide to save on fuel and extend the lifetime expectancy by allowing the satellite to drift a little bit. These stations have to be equipped for tracking the satellite such as omni-directional antennas that make precise pointing of the antenna unnecessary. However, line of sight should not be obstructed by walls, roofs, and excess foliage.

The payload for a communications satellite includes large antennas to transmit TV or telephone signals to Earth, and may differ substantially from a weather satellite that includes cameras to take pictures of cloud formations. Payload includes a transponder that filters and translates signals received from the transmitting Earth station, then redirects them to the transmitting antenna on board. Communications satellites carry a large number of transponders on board (normally from six to more than 24), enabling them to deliver multiple channels of communication at the same time. These channels are called carriers. Onboard processing is a major step in the implementation of new technologies onto satellites. In the case of Iridium and many of the Internet access satellites, satellites act as mini switchboards in the sky. The communication functions of a satellite (antennas, processors) are powered by electricity provided through a combination of solar energy and batteries that regulate power supply when the satellite approaches the shadow of the Earth.

Antennas are a part of the payload that receive the original signal from the transmitting Earth station and re-transmit this signal to the receive stations on Earth. The antennas that were used in the past were omni-directional (transmitting signals in every direction) and not very effective. Now, more efficient high-gain antennas (most often dish shaped) point quite precisely towards the areas they are servicing. Later developments now permit re-pointing of the so-called steerable antenna to cover a different area or reshaping or reformatting the beam. Additional developments allow for a highly precise and efficient reshaping of the transmitted beam. Small coverage areas defined as pencil beams may facilitate the differentiation of services within large regions. The antennas on board the satellite are typically limited in size to around 2-3 m by the space that is available on the satellite structure.

Satellite communications, like any other means of communication (radio, TV, telephone, etc.) use frequency bands that are part of the electromagnetic spectrum. C-band is the oldest allocation and operates in the frequency range around 6 GHz for transmission (uplink) and between 3.7 and 4.2 GHz for reception (downlink). Ku-band is the most common transmission format in Europe for satellite TV and uses around 14 GHz for uplink and between 10.9 and 12.75 GHZ for downlink. Ka-band uses around 30 GHZ up- and between 18 and 20 GHZ downlink frequency. C-band and Ku-band are becoming congested by an increasing amount of users, so satellite service operators are more and more turning to the use of Ka-band.

Satellite operators choose bands based on different factors. Although C-band is still the most widely available worldwide, Ku-band is becoming more available recently in regions that were less covered in the past (South America, Asia, Africa). C-band is more prone to interference from other transmission services

that share the same frequencies, such as adjacent satellites or terrestrial transmissions. While the C-band technology is less expensive in itself, it requires larger dishes (1 to 3 m) than Ku- and Ka-band (0.6 to 1.8 m) and therefore imposes higher installation costs on the user. Ku- and especially Ka-band make better use of satellite capacity and these higher frequency bands suffer from signal deterioration caused by rainfall. To ensure availability in bad weather conditions, the signal has to be much stronger. Wireless systems that utilize satellites may experience "rain fade" and solar interference at various times.

One wireless Local Area Network (LAN) technology utilized between a receiver and its ultimate destination is a wireless technology entitled "Wi-Fi" (Wireless Fidelity or IEEE 802.11). When Wi-Fi is used, a fixed base station is utilized as the transceiver to set-up a Wi-Fi zone for use by destination devices such as laptop computers having special hardware and software. The destination devices typically must be located within 300-500 feet of the base station within the Wi-Fi zone.

Business Considerations

Efforts of government agencies to contribute to the development of space travel have often been in conflict with business interests of corporations and political influences in Congress. Thus, despite divergent investments in different systems by NASA and the Department of Defense before 1962, COMSAT (formed as a result of the Communications Satellite Act of 1962) launched a first communications satellite in 1965. For example, in 1965, ABC proposed a domestic satellite system to distribute television signals. The proposal sank into temporary oblivion, but in 1975 TELESAT CANADA launched the first domestic communications satellite, ANIK, to serve the vast Canadian continental area. RCA then leased circuits on the Canadian satellite until they could launch their own satellite. The first U.S. domestic communications satellite was Western Union's WESTAR I, launched on April 13, 1974. In December of the following year RCA launched their RCA SATCOM F-1.

In early 1976 AT&T and COMSAT launched the first of the COMSTAR series. These satellites were used for voice and data, but very quickly television became a major user. By the end of 1976 there were 120 transponders available over the U.S., each capable of providing 1500 telephone channels or one TV channel. Very quickly the "movie channels" and "super stations" were available to most Americans. The dramatic growth in cable TV would not have been possible without an inexpensive method of distributing video. The following two decades have seen some changes: Western Union is no more, Hughes is now a satellite operator as well as a manufacturer, although DIRECTV was spun off to News Corporation early in 2004; AT&T is still a satellite operator, but no longer in partnership with COMSAT; GTE, originally teaming Hughes in the early 1960's to build and operate a global system as a major domestic satellite operator. Television still dominates domestic satellite communications, but data has grown tremendously with the advent of very small aperture terminals (VSAT's).

In 1965, when EARLY BIRD was launched, the satellite provided almost 10 times the capacity of the submarine telephone cables for almost 1/10th the price. This price-differential was maintained until the laying of TAT-8 in the late 1980's. TAT-8 was the first fiber-optic cable laid across the Atlantic. Satellites are still competitive with cable for point-to-point communications, but the future advantage may lie with fiber-optic cable. Satellites still maintain two advantages over cable: they are more reliable and they can be used point-to-multi-point (broadcasting).

In 1993, six companies provided fixed satellite service to the U.S.: GE Americom, Alascom, AT&T, COMSAT, GTE, and Hughes Communications with 36 satellites with a net worth of over four billion dollars. The ground stations that communicate with these satellites are innumerable and may have a similar net worth. INTELSAT has had competition in the international market from Pan American Satellite since 1986. Since Canada began domestic satellite service in 1972, that country has been jointed by the United Sates (1974), Indonesia (1976), Japan (1978), India (1982), Australia (1985), Brazil (1985), Mexico (1985), and many others. Each year from 10-20 communications satellites are launched valued at about $75 million 1993 $) each. The launch vehicles placing them in orbit have similar values. Both satellites and launch vehicles are multi-billion dollar businesses.

As an example, Hughes Electronics Corporation, a world-leading provider of digital television entertainment, broadband satellite and network services, and global video and data broadcasting reported revenues of $8.9 billion in 2002 for four main operating units; DIRECTV, DIRECTV Latin

America, Hughes Network Systems, and PanAmSat Corporation. DIRECTV offers more than 850 broadcast channels of sports, news, movies and family programming, including local broadcast channels in 64 television markets, high definition and foreign-language programming, and up to 38 channels of commercial-free, digital-quality music to more than 12 million customers in the United States and operates a fleet of seven satellites. DIRECTV Latin America operates five broadcast centers, which beam more than 9,000 hours of programming a day over 450-plus audio, video and data channels with content from Latin America, the United States, Europe and Asia. In 2004, HNS will launch SPACEWAY, a high-capacity, next-generation Ka-band satellite system that will enable new multimedia applications.

However, many business plans are tightly controlled and linked to intellectual property interests of the participants. In preparation for this article, satellite communication companies declined the opportunity to comment upon business plans, patent pool participation and testing procedures that may provide competitors or suppliers with information that could weaken the company's own position.

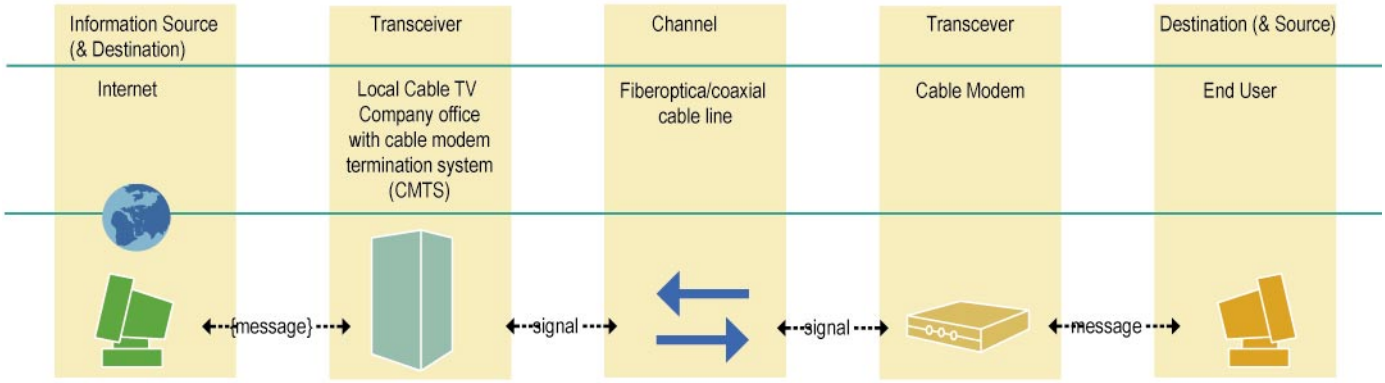
Wireless Internet technology is rapidly "coming of age" and by most accounts will shortly be a viable competitor in the race for the "last mile."

Legal Considerations

Availability of alternative "last mile" technologies such as wireless Internet technology lessens the strength of arguments for compulsory sharing of a particular technology.

The Telecommunications Act of 1996 has hindered the increased use of satellite technology. As directed by Congress in Section 207 of the Telecommunications Act of 1996, the FCC promulgated a rule, cited as 47 C.F.R. § 14, effective October 14, 1996, that prohibits unreasonable restrictions that impair the installation, maintenance or use of antennas, including satellite receivers, used to receive signals. Although this rule seems to give satellite dish users the right to place a dish on their premises without municipal or contractual restriction, the rule carves out an exception that allows local governments, community associations and landlords to enforce certain restrictions. These entities have used this regulatory groundwork to hamper a user's access to satellite signals, which has slowed the widespread adoption of this technology.

CABLE MODEM TWO-WAY MODEL



V. Cable Modem Two-way Model

Technical Considerations

When cable television (CATV) systems were originated, only television service was originally provided to end users. Now, high-speed data and television service may be provided over the "last mile" to consumers.

Before a cable modem termination system (CMTS) sends signals over the cable line, it must first modulate the signals. Much like the DSLAM of the DSL model, the CMTS aggregates the connections from many end users into a single, high-speed Internet connection to an Internet Service Provider (ISP). At the transmitter, the television signals are also added.

Some systems use a channel of only coaxial

cable while other systems use fiber-optic cable which extends to different neighborhoods. Then, the signals move from the fiber-optic cable into coaxial cable for distribution to individual end users.

The coaxial cable has an available bandwidth and can be viewed as having a bundle of pipes or channels through which signals of different frequencies travel. For example, one particular television channel can be given a slice or pipe of the total bandwidth. High-speed data or signals to and from the Internet are given their own channel or pipe on the coaxial cable.

A relatively new telephone service utilizing Voice Over Internet protocol (VoIP) technology using "packet-switching" may be provided in this model. Packet-switching allows individual messages to be subdivided into smaller "packets" that may be sent along different paths to the destination where they are reassembled by the receiver in their correct sequence. The subdividing and the reassembling are performed by computers at the transmitting and receiving ends, respectively. Packet-switching may eventually replace the circuit switch technology of telephone networks.

The cable modem at the end user includes a modulator and a demodulator to provide two-way communication as well as a microprocessor to help separate the television signals from the high-speed data or message.

Business Considerations

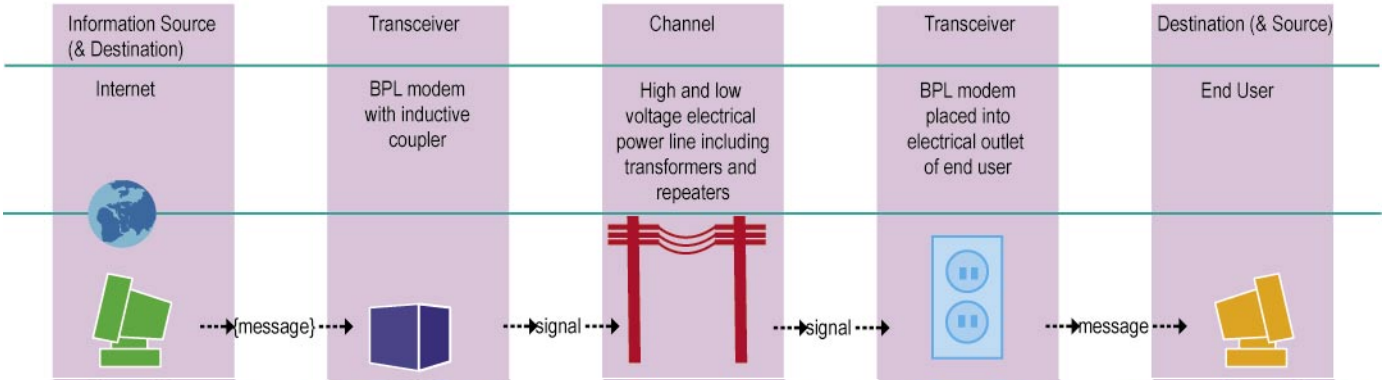
There are about sixty million users of this technology in the United States.

Legal Considerations

Like the telephone system, regulatory agencies sometimes force CATV companies to lease their lines and equipment to competitors who, in turn, provide telephone service to end users. Congress' stated intent in the deregulation of cable was to stimulate competition, and to reduce prices. But the trend has been toward higher prices. There is a question as to whether regulation or competition is an appropriate answer to the problem of higher communications rates.

The FCC is still struggling with the issue of whether or not to apply telephone regulation rules to VoIP.

BROADBAND POWER LINE (BPL) ONE-WAY MODEL



VI. Broadband Power Line (BPL) One-way Model

Technical Considerations

This is a largely experimental technology. However, it is attractive because the electric distribution network extends almost everywhere including almost everywhere within the destination. Inductive couplers are used to connect BPL modems to medium voltage power lines (i.e., the electric lines that one sees at the top of utility poles beside roadways). The inductive coupler wraps around the medium voltage power line to transfer the high-speed data signal onto the power line. One problem is that transformers, which lower (i.e., transform) the medium voltage (i.e., thousands of volts) into a low voltage (i.e., 220/110 volts) for use by the end user break apart the data signals. Potential solutions are available, but are currently costly. Another problem on some installations is interference to and from signals, particularly on the low voltage power lines in the "last mile" of the electric distribution network.

Business Considerations

The technology is potentially very costly because repeaters are needed to periodically amplify the data signals appearing on the power lines.

VII. Some Telecommunication/ information Technology Trends

1. The use of mobile phones is increasing at the expense of fixed-line phones.

2. The continued demand and growth of faster Internet access speeds both to and from end users.

3. The overlap between information technology and telecommunications is continuing to increase or converge as relatively new Internet technology appears to be dominating the "old" telecommunication technology. For example, in the corporate telecommunication market, new Internet-based technology to interconnect regional offices via virtual private networks provides advanced data services as well as connectivity. Such networks may provide broadband, Ethernet-based, data transmitters in local area network (i.e., LAN) and wide area network (WAN) environments.

4. Also, voice calls are being conducted over corporate data networks utilizing technologies such as Voice Over Internet Protocol (VoIP). In this technology, voice calls are digitized and placed into packets of Internet data. Such technologies may eventually replace separate voice networks wherein voice and data are provided over a single communications channel. Presently, a large amount of optical fiber is in place wherein the transmitter includes optical transmission equipment such as lasers and/or light-emitting diodes. However, the "last mile" to the receiver of the end user typically is not optical fiber, but rather, is a copper telephone wire. The future may bring a fiber-optic "local loop" to provide this "last mile" to the receiver which may include a photodetector diode. Alternatively, this last mile of service may be provided by wireless local loops. Various companies are battling for the "last mile" of infrastructure access to the customer's premises since they believe that the owner of this "last mile" will eventually provide all of the customer's future telecommunications needs including local and long distance telephone service, broadband Internet access and video/cable service.

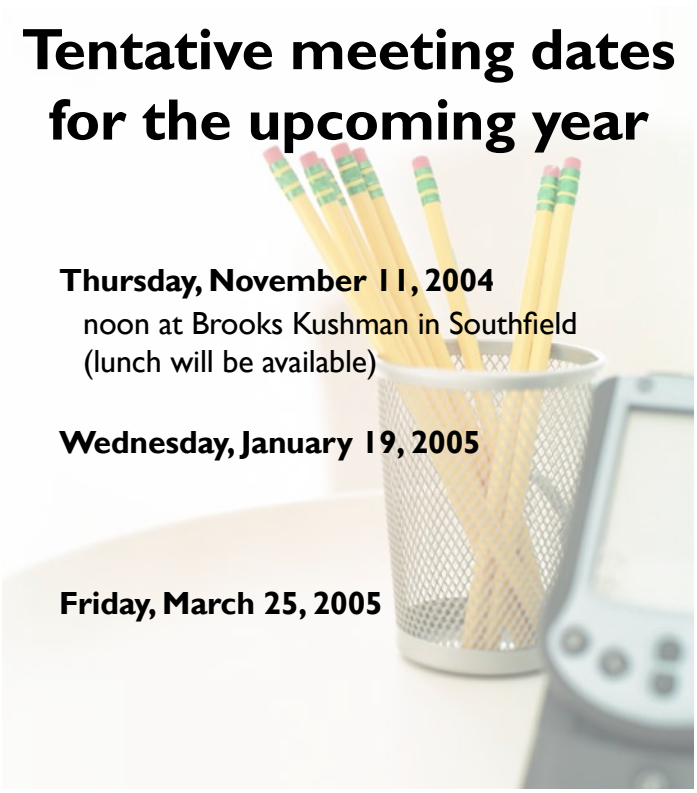
This paper was written by Chairman, David R. Syrowik of Brooks Kushman P.C., Southfield, Michigan. Committee members working on this project were; John R. Buser, Mitchell A. Goodkin, William M. Hanlon, Jr., Mary I. Hiniker, Thomas M. Iacobelli, Matthew M. Jakubowski, James N. Kallis, Ronald M. Nabozny, Paul J. Raine, Thomas W. Saur, and Tyrone C. Tartt. The paper was presented at the Computer Law Section Annual Meeting on September 9, 2004 in Walled Lake, Michigan.

Footnotes

[1] Trend No. 10 in the "Top Ten Technology Trends" prepared by Jeff Kirkey and Gary Kendra for the November 13, 2003 meeting of the Technology Law and Training Advisory Board of ICLE reads as follows: "10. Lawyers who do not understand technology and its implications on their practices will fail. You may think that technology plays a major role in a typical lawyer's life today – just wait. Failing to prepare for and respond to technology trends may be the biggest mistake a lawyer can make. Those who are ambivalent toward technology will certainly not thrive in the future and may not survive."

Proprietary Rights Committee, Computer Law Section Meeting directly following section meeting on Thursday, November 11, 2004, noon at Brooks Kushman in Southfield.

Tentative meeting dates for the upcoming year



Thursday, November 11, 2004
noon at Brooks Kushman in Southfield
(lunch will be available)

Wednesday, January 19, 2005

Friday, March 25, 2005

At The 2004 Dayton Seminar
Cutting Edge Technology Topics Abound

by Kimberly A. Paulson

On June 29, 2004, I made my return to Dayton, Ohio, for the Fifteenth Annual University of Dayton School of Law Advanced Computer & Cyberspace Law Seminar. The event is back to being held in the law school after a brief foray to a convention center downtown. Once again, the seminar did not disappoint.

Topics Worth Sticking Around For

The topics were timely and topical. Open source software was the focus of two presentations. First, John R. Ackermann from NCR Corporation discussed its philosophical underpinnings and various licensing arrangements. Discussing an article by Eric S. Raymond called "The Cathedral and the Bazaar," Mr. Ackermann explained that supporters of open source software contend that the open source model creates a more perfect market and a better product than the "closed" model ever could. Apparently, many open source supporters look at the software development process as an "evolutionary" one, and assert that the traditional model of software development lags seriously behind the open source model in the evolutionary process.

Mr. Ackermann then proceeded to discuss some of the different types of licenses governing use of open source software. In particular, he focused on the General Public License ("GPL"). He pointed out the difficulty in understanding and using the GPL, largely because its provisions are so completely different from those of traditional software licenses. For instance, the GPL encourages distribution of the program's source code, as opposed to limiting it. He also emphasized the risks one takes by incorporating any GPL'd code into one's software. Essentially, any derivative work one creates using GPL'd code becomes subject to the GPL, including the obligation to provide full source code and allow unlimited distribution without charging a license fee. Mr. Ackermann also discussed the pros and cons of the Lesser GPL ("LGPL"), used when incorporating only GPL'd code from a pre-existing standard "library" of software routines. He warned that while the LGPL is beneficial in that it does not require the distribution of source code, it still may require the distribution of other files and tools that are not normally given to end users.

Peter Lord of Oracle also spoke on the topic of open source software, but his presentation focused on open source encryption technology in light of export administration regulations. He explained that because open source software is more difficult to control, it is especially important to monitor such software for compliance with the U.S. Government's encryption export regulations. However, he noted that the Bureau of Industry and Security ("BIS") has acknowledged the "open nature" of the software and has updated the regulations to provide that "publicly available" encryption source code may be exported or re-exported without review, provided written notification is submitted that includes that Internet location or a copy of the source code by the time of export. The only exception is that the exporter may not knowingly export the code to any of the enumerated prohibited countries. Regardless, Mr. Lord emphasized that companies dealing with open source encryption must still be diligent about checking against the government's lists of prohibited buyers, and encouraged companies to adopt an automated system for performing such checks. He also noted that the definition of "export" under the regulations is very broad and could include revealing information during a speech, in the course of teaching, by posting on the Internet, or by simply allowing a foreign national some form of access to the code. In conclusion, Mr. Lord explained that a company must understand the manner in which information is flowing within its own operations and must put protections in place to guard against inadvertent inappropriate "export" of encryption code.

The topic then turned to willful patent infringement. Although not necessarily a cutting edge topic, because of the Federal Circuit's pending review of a potentially landmark case, the topic was timely. Amy Landers of Orrick, Herrington & Sutcliffe focused on the effect of opinion of counsel, including

an adverse inference for lack thereof, on a finding of willful infringement. She reviewed the current state of the law and provided practical tips. Among others, her suggestions included keeping all drafts of opinion of counsel, supplementing an opinion where necessary, and keeping opinion counsel separate from litigation counsel in order to preserve their independence and protect privilege. Most importantly, the speaker focused on the recent case of *Knorr-Bremse Systeme Fuer Nutzfahrzeuge GmbH v. Dana Corporation*, for which the Federal Circuit granted sua sponte en banc review. At the time of the seminar, the Federal Circuit had heard oral arguments but had not yet released an opinion. However, Ms. Landers explained that the outcome of this case could change two decades of precedent as to the question of willful infringement and the adverse inference for failure to present opinion of counsel. This case has since been decided by the Federal Circuit and can be found at 2004 WL 2049342, --- F.3d --- (Fed. Cir. , Sept. 13, 2004). A quick perusal reveals that the Federal Circuit made a significant ruling regarding adverse inferences, specifically that an adverse inference that legal opinion was or would have been unfavorable should not be drawn from a patent infringement defendant's invocation of attorney-client and/or work product privileges or from such defendant's failure to consult with counsel. This decision overrules two prior Federal Circuit decisions, and Ms. Landers was correct in her assessment that this decision could significantly affect future patent infringement cases.

E-commerce was also a popular topic, with two speakers presenting different aspects. First, Marco Kerschen of Procter & Gamble focused on recent legal issues in e-commerce. He began by discussing the CAN-SPAM Act of 2003, and pointed out its pros and cons. For instance, he explained that the Act brings much needed uniformity to the war on spam and provides potentially harsh penalties. However, he noted that the Act made many concessions to so-called "legitimate" marketers, which will likely still allow a significant amount of unwanted e-mails. Also, the Act is less stringent than some of the state laws it preempts and far less stringent than comparable EU laws. He opined that technology was likely to be a far better spam deterrent than legislation. He also discussed the relatively new "Truth in Domain Name Act" which was quietly passed in 2003. This Act makes it illegal to use a "misleading domain name" with the intent to deceive a person into viewing obscenity or material "harmful to minors" on the Internet. The speaker opined that the law is filled with ambiguities and likely to be found unconstitutional if challenged, especially since it subjects violators to possible prison time. The speaker also addressed Internet taxation, which he explained was subject to a moratorium until November 2007. He commented that while many feel the moratorium is necessary to promote growth of e-commerce, others argue that significant tax revenues are being lost and brick & mortar stores are at an unfair disadvantage. He also noted that the legislature is still negotiating the issue of taxes on Internet access. While the legislature seems inclined to ban them, it's unclear for how long the ban would ultimately last. He also discussed EU tax policy, which is currently inconsistent, as the VAT registration requirement varies among different EU member countries. A single registration is being discussed. Taxation of Voice over Internet Protocol ("VoIP") is another issue that is being hotly debated and on which a decision is pending. Finally, the speaker discussed radio frequency identification ("RFID"), which are tiny electronic tags used for identification purposes in a variety of applications. They are currently used in security passes and speedpasses but are expected to be used more frequently for applications from retail inventory control to law enforcement. Not surprisingly, privacy advocates are concerned about the potential abuses that could result from the use of RFID and are calling for regulations regarding the use of such technology.

The second speaker on E-commerce was Dino Tsibouris of Mallory & Tsibouris, who discussed Online Agreements and Electronic Records. He examined some cases in which courts were asked to enforce on-line agreements and the varying results. In the 2001 case *Shattuck v. Klotzbach*, for instance, a court refused to dismiss plaintiff's claim, which alleged that a contract for the sale of real estate was formed through an exchange of e-mails. The opposite result was reached in *Campbell v. General Dynamics*, a 2004 case in which a court refused to enforce a mandatory arbitration provision added to the employee's contract through e-mail notification. Mr. Tsibouris explained that the court was especially influenced by the facts that an employment situation was at issue and previously all provisions and modifications had been expressed in paper form. On the topic of click-wrap agreements, the speaker discussed three cases: *Groff v. America Online, Inc.*, *Caspi v. Microsoft Network*, and *AOL v.*

Pasieka. In the first two cases, the court held that the click-wrap forum selection clauses were valid and enforceable. In the third case, the opposite conclusion was reached, but it was based on concerns over the remedies available under the law of the selected forum, not the agreement itself. These cases suggest that click-wrap is a generally acceptable form of on-line agreement under the law. Next, Mr. Tsibouris turned to the topic of browse-wrap agreements. He again discussed three cases addressing the enforceability of these types of agreements, *Pollstar v. Gigmania*, *Specht v. Netscape*, and *Net2Phone, Inc. v. Superior Court*, and explained that the results varied. Essentially, he noted, the more conspicuous and accessible the notices and terms of agreements, the more likely a court is to enforce a browse-wrap agreement. He also cited to a report by the ABA Joint Working Group on Electronic Contracting Practices, which sets forth four key elements to consider when determining the enforceability of a browse-warp agreement: 1) whether the user is provided with adequate notice of the existence of the proposed terms; 2) whether the user has a meaningful opportunity to review the terms; 3) whether the user is provided with adequate notice that taking a specified action manifests assent to the terms; and 4) whether the user takes the specified action. He also pointed out that increasingly less and less is required to form a contract, citing to the progression from shrink-wrap to click-wrap to browse-wrap.

Another cutting edge topic was Google's new Gmail, which was discussed by Marcia Hoffmann of the Electronic Privacy Information Center. Ms. Hoffman admitted that she was torn between her love of Gmail and her natural concerns as in-house counsel for a privacy advocacy organization. Gmail has received a great deal of publicity, as well as criticism, for its unique, and seemingly invasive, techniques. First, Gmail allows users to search every e-mail ever sent or received using advanced search features. Second, it provides each user with a previously unheard of one gigabyte of free storage. Gmail also organizes communications into conversation-like formats, so that each message appears in context. These are all very handy features that are universally adored by Gmail users. However, the privacy concern arises in the way Google finances this free e-mail service. Google scans the text of each email to target text ads to users that are relevant to the content of the message. The speaker also noted that Google appears to target ads relevant to the location of the user and even relevant to the ethnic or cultural aspects of a user's name. Ms. Hoffman questioned whether such techniques might violate the Electronic Communications Privacy Act and wiretap laws. Although Google claims that the process is completely automated and that no information is personally collected or conclusions reached, the process of popping up ads that relate to an individual's personal information still has that "creepy" factor. In addition, not all senders or recipients of the messages will necessarily be Gmail users. Can Google properly scan the messages of non-Gmail users without their knowledge or permission? There are also concerns about confidential communications, such as those that may be subject to a privilege. Might a privilege be accidentally waived or otherwise compromised by Google's scanning techniques. Furthermore, Ms. Hoffmann noted that the immense storage capacity provided by Gmail encourages users to retain all messages indefinitely, thus creating an extensive online record of each user's communications. In conclusion, Ms. Hoffman opined that Gmail has raised the bar and is setting the standard for future e-mail services. She also noted that laws will need to arise or adjust to address these unique new issues and will ultimately determine where this type of technology will end up.

The subject of peer-to-peer file sharing is obviously still a hot and controversial issue, as two speakers presented different points of view on that topic. The first to speak about the topic was Matthew Neco from Streamcast Networks. It was obvious that Mr. Neco held a certain bias in favor of P2P services and against those trying to shut them down. However, instead of taking away from the credibility of the presentation, I personally felt as though the speaker's obvious convictions made it more interesting and valid. It reminded me a little of this year's spring luncheon, where the speakers unquestionably arrived with strong points of view on the issue of P2P music sharing. Like at the luncheon, this speaker's passion about the topic made even a clearly biased presentation fun and interesting. First, Mr. Neco discussed Morpheus, Streamcast's software product. He explained that Morpheus defies pigeonholing, as many courts and others have tried to do. In other words, Morpheus is not a "system," "network," "service," or "spyware," which has allowed it to avoid liability in copyright suits. Mr. Neco also vehemently denied the validity of the RIAA's claims that file sharing is the cause of the

decrease of music sales and that Morpheus is itself in violation of the Copyright Act. He commented that the peer-to-peer music industry is a great technological innovation that is here to stay. Even if the U.S. eventually outlaws the technology, he opined, the industry with go offshore and underground. He also opined that current copyright laws are in need of serious reworking. Finally, he lamented the inability to find middle-ground with the RIAA, despite numerous licensing options.

A more neutral view was presented in the next presentation, which was an overview of the file sharing lawsuits. Our old friend Rob Lech was scheduled to give the presentation but couldn't make it, so his colleague Tim Connors appeared in his stead. He contrasted the Napster decision, which found vicarious and contributory infringement on the part of Napster, with cases addressing Grokster and Morpheus, which found no contributory or vicarious infringement due to the decentralized nature of their products. He noted that the rulings have been mixed and in some cases inconsistent. He also addressed the recent RIAA cases against individuals found to be illegally downloading music and the roadblocks the RIAA has hit along the way. Mr. Connors noted that too much law might defeat the very purpose of copyright law by stifling innovation instead of encouraging it and that a better balance needs to be found. He also noted that the business models and practices within the music industry are undergoing many changes, with alternative distribution methods and new collection methods being used. He further explained that fans now have more say in how and from where they get their music, which is likely to result in a better system. In conclusion, Mr. Connors opined that the "system" needs to be improved to accommodate technology, give fans what they want, and get money to the artists.

International IT outsourcing, another topical legal issue, was also discussed at the seminar. The speaker was Mark Traphagen from Collier Shannon Scott, who has also been involved in drafting the DMCA, WIPO Internet Treaties, and the Free Trade Agreement of the Americas. Steve Tupper and I also had the privilege of eating lunch with Mr. Traphagen. Most significant in his presentation were his practical tips on protecting a company's intellectual property. First, he emphasized that a company must select an overseas licensee very carefully, doing proper research and due diligence first. He further suggested that a company make sure its intellectual property is properly registered under the laws of all relevant countries, including with customs officials. Mr. Traphagen also emphasized that a company must include strong IP protection provisions in the outsourcing agreement and then monitor the licensee's conduct closely to confirm compliance. He advised the agreement should make clear who owns what IP and set forth the process to be used for formalizing assignments of IP rights if necessary. He also addressed confidentiality clauses. He recommended that a company conduct thorough research to determine the laws of relevant countries in order to determine each party's obligations and draft the clause accordingly. Finally, Mr. Traphagen emphasized the importance of the choice of law provision in the agreement. He encouraged conducting thorough research in order to draft a choice of law clause that is likely to be enforced. In addition, he noted that once that decision has been made, a company must remember to customize the rest of the contract in accordance with the law chosen.

A Worthwhile Trip

Once again, I can say that the Dayton seminar was very worthwhile. The seminar rivals more high profile and more expensive seminars in its topics, speakers, and informal atmosphere (not to mention location at a mere three hour drive from the Detroit Metro area). Speakers are completely accessible and happy to speak, or have lunch with, the attendees. The seminar materials, as well as the presentations, are high quality. At just under $400, the seminar is a great deal.

I will definitely return next year, and I encourage all section members to do so as well. In the past the Computer Law Section has acquired a few free passes for its members, some of which have, sadly, gone unused. If we can acquire some again this year, DO NOT miss out on that opportunity. Look for announcements in spring 2005 regarding next year's seminar and the availability of free passes.

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