Face-off – ISDN vs. DSL

by

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Abstract

The desire for speed is increasing. This is not about drugs, but in the realm of telecommunication bandwidth. Individuals, such as you and I, are demanding faster access to the World Wide Web (WWW) from our homes. There are many alternatives in order to satisfy the need for speed. This research paper details briefly what ISDN and DSL are. In addition, a comparison between the two is exhibited.

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It is a Saturday afternoon when it seems everyone who wants to do their grocery shopping is at Meijer <http://www.meijer.com>. Yes, the aisles are packed with numerous shopping carts along with those infamous envelopes of coupons. Who could resist saving 50 cents when you buy something of two? Coupons have become a very strategic part of grocery shopping life.

There I was, with my groceries on the black conveyor for the cashier to check me out next. However, to my surprise the gentleman in front of me had many coupons. The cashier is getting ready to scan the last coupon, I can see that my fervently waiting is coming to an end. I can sense that I will be heading to my truck soon so I can go home. But no! The coupon will not scan. Apparently he has not brought what he has suppose to get the savings. He looks at the coupon and says he has brought the 32 ounces of mayonnaise as required. The cashier looks at the coupon and says he needed to buy two of them. The gentleman then looks at the coupon and proceeds to tell the cashier she must have read it incorrectly. It states the holder of the coupon must buy two 16 ounces or 32 ounces of Miracle Whip mayonnaise. Of course, the gentleman not to be told otherwise, insisted the cashier is incorrect and to scan the coupon. At this point in time, the lady behind me is expressing her dislike of the situation very loudly. After some haggling back and forth, the gentleman decides he just does not need the mayonnaise anymore and tells the cashier to take it off his bill.

There is one underlying moral to this story. People do not like waiting. Individuals, such as the woman behind me, agonize over how long she will wait. Waiting has become an integral part of all our lives. Therefore, the person and/or business that can throw the queuing theory out the window would be rich. Everyone would like to be served immediately with no wait. This same desire is exemplified when individuals access the World Wide Web (WWW) from home. Individuals are demanding that their wait time be decreased. The 56k modems are just not cutting it. When individuals surf, they want the web site to come up immediately on their screen with no wait. How often have you seen these phases “please wait, downloading 3k of 5,200k” or “web site found, waiting for reply”.

Yes, reducing wait time has become big business and controversy. “Even the masters of the universe share your pain: ‘Bandwidth bottlenecks’ Bill Gates says, ‘are the biggest obstacle to where we’d like to take the PC.’ His neighbor on Olympus, Andy Grove, tells a similar tale: ‘We’re just a step away from the point when every computer is connected to every other computer. As exciting as that is, though, there’s one big problem: telecommunications bandwidth” (Brookshaw, 1998).

Bandwidth is not a problem at the core information structure, but what is generally called the “last mile”. Consumers who sit at home are forced to “sip it thirstily through a narrow pipe”. This narrow pipe has been dubbed the “last mile”. “In general terms, the last mile is the portion of a wide area network that runs from a user to the nearest aggregation

point or hub. Most often that is the telephone company's local loop running from homes and businesses to a central switching office or exchange" (Brookshaw, 1998).

Today, though, there are many options for the everyday user to acquire more bandwidth. Bandwidth is available in two forms – expensive and plentiful or affordable and not enough. However, there are some last mile alternatives to help obtain more than the 14.4, 28.8, or even 56k. Two of the ones described in this paper are ISDN and DSL. Each is in the race to try to become the de facto standard of the last mile. Both have their advantages as well as disadvantages. This research paper details briefly what ISDN and DSL are. In addition, a comparison between the two is exhibited.

Last Mile Alternatives

ISDN

Integrated services digital network (ISDN) "is a system of telephone networks that allows date, images, voice, and video to be transmitted simultaneously on a single digital channel. It can operate through the standard telephone jacks in offices and homes using existing copper telephone wiring (usually without special conditioning). Since ISDN is entirely digital, there is no analog to digital conversion, and users benefit from the full bandwidth of each channel" (Aber, 1998).

In a typical telephone setting a separate line is required for each additional device such as another telephone, a fax or a computer. ISDN eliminates this requirement since it is capable of combining the separate data signals into one single channel. The circuit switched bearer channels (B channels) of ISDN is 64 Kbps and is capable of carrying both voice and data. The delta channel (D channel) can be either 16 Kbps or 64 Kbps, which handles out-of-band signaling and control. "This out-of-band signaling capability allows call setup with 1 to 3 seconds – compared to as much as 40 seconds for analog modem calls" (Aber, 1998). Lastly, the newest feature of ISDN is always on/dynamic ISDN (AO/DI). "AO/DI uses ISDN's D channel packet service to maintain an 'always on,' low speed (9.6 Kbps), TCP/IP connection between a user and an information service provider or corporate LAN" (Aber, 1998).

ISDN comes in three types. They are basic rate interface (BRI), primary rate interface (PRI) and broadband ISDN (B-ISDN). "BRI offers 144 Kbps symmetrical service. PRI is for users with greater capacity requirements and allows aggregation of multiple B channels with bandwidth equivalent to T1 facilities. Unlike dedicated, point-to-point T1 lines, ISDN is a switched service and relies on an intelligent switching network. Still evolving, B-ISDN will support as much as 622 Mbps using ATM technology as a switching infrastructure. Its implementation depends on the availability of optical fiber networks" (Aber, 1998). Generally, BRI connections via ISDN terminal adapters are present in the last mile configuration.

There are two big providers of ISDN. One is Bell Atlantic <http://www.bellatlantic.com> with 458,000 basic rate and 24,056 primary rate ISDN lines throughout its region. Ameritech is the other. Ameritech <http://www.ameritech.com> has provisioned 133,700 ISDN lines with 123,300 being basic rate and 10,400 being primary rate (Morri, 1998).

DSL

DSL is the hottest topic going this side of the river. In fact, in the business community it is generally referred to as "that kind of new connection" (Robles, 1998). Telephone companies are responding to the small business world as well as to the consumer with something called DSL. Digital Subscriber Line (DSL) is a group of technologies that deliver high-speed LAN and Internet access over telephone lines.

"DSL uses modern digital processing techniques to use the installed copper infrastructure and create high-speed remote digital links up to 18,000 feet without digital-to-analog conversions. A DSL Access Multiplexer (DSLAM) connects to existing copper phone wires that run through building riser to user desktops in a large building or campus, for example. User PCs connect to a DSL modem via standard ethernet connections and the DSLAM, used in place of standard telephone voice switches, multiplexes data traffic from DSL lines to an ATM interface" (Patton, 1998).

DSL comes in many flavors – six to be exact. There is ADSL, HDSL, ISDL, RADSL, SDSL, and VDSL. Asymmetric DSL (ADSL) is the most flexible variation of the DSL technologies. "It supplies numerous upstream and downstream rates. ADSL will likely become the most popular flavor among small business and home users. Upstream maximum speed: 1 Mbps; downstream maximum speed: 9 Mbps; maximum distance from cbL corporate office (CO): 5.4 km" (Patton, 1998).

High bit-rate DSL (HDSL) is the oldest variation of DSL technologies. It is used for wide-band digital transmission within corporate sites and telephone companies who require two twisted pair and use T1 lines. "Upstream maximum speed: T1 speed; downstream maximum speed: T1 speed; maximum distance from CO: 3.6 km" (Patton, 1998).

Integrated digital services DSL (ISDL) is a variation that is closer to ISDN data transfer rates and services. It can be activated on any ISDN line. "Upstream maximum speed: 128 Kbps; downstream maximum speed: 128 Kbps; maximum distance from CO: 5.4 km" (Patton, 1998).

Rate-Adaptive DSL (RADSL) is a variation that supports software to automatically and dynamically adjusts to the rate at which signals can be transmitted on a given customer phone line. "Upstream maximum speed: 1 Mbps; downstream maximum speed: 12 Mbps; maximum distance from CO: 5.4 km" (Patton, 1998).

Single-line DSL (SDSL) is a modification of HDSL. “Upstream maximum speed: 768 Kbps; downstream maximum speed: 768 Kbps; maximum distance from CO: 3 km.” Very-high data rate DSL (VDSL) is the latest development in the DSL family. It is still a developing technology. “Upstream maximum speed: 2.3 Mbps; downstream maximum speed: 52 Mbps; maximum distance from CO: 1.35 km” (Patton, 1998).

Telephone companies seem to have left no one out when they developed this new technology. DSL has a variety of configurations for the marketplace. From the small business owner to the homeowner, there is a DSL flavor to appease just about anyone.

The Comparison

The prospects of ISDN sound promising. However ISDN faces stiff competition from this new evolving technology called DSL. There are many differences that make DSL stand out from its competition. One of the differences is that DSL only requires one pair of non-loaded, dry copper wires, also referred to as a LADD circuit or dry metallic pair. This is unlike ISDN where two dry pairs and four wires are required. “This difference is a big one since it cuts facility requirements in half” (Robles, 1998).

One advantage that ISDN has over DSL is its standardization and availability. “Relative to other high speed data services available in the United States, ISDN is much closer to ubiquity. Although less than 50 percent of total access lines in the United States were connected to an ISDN-capable switch at the end of 1994, the percentage of telephone subscribers who have direct access to ISDN is now approximately 85 percent” (IDC/LINK..., 1998). This is a figure that DSL will not approach for years. DSL is an emerging technology that is available in only certain areas. In addition, since DSL in its early stages, standards have not been resolved. “Standards for DSL signaling and coding techniques need to be worked out, and the industry still doesn’t know what to do with lines with long loop lengths” (Morri, 1998).

Standards lead to another issue with DSL versus ISDN. One of the biggest challenges is the confusion. Remember DSL comes in many different flavors. The question becomes “how many different speeds can you offer them before you confuse them to death?” (Lindstrom, 1998). In addition, these various flavors are not interoperable. “The problem comes after you own the DSL modem for your end, then change carriers. The modem you own might not work with the equipment your new provider uses” (Greene, 1998).

Another advantage that ISDN has over DSL is its two B channels. “With its two B channels, ISDN lets users perform two voice functions simultaneously. DSL, on the other hand, rides on a voice message and allows for only one voice function. For the small and home office markets, DSL often will not be the best solution. Although DSL users can talk, receive a fax or do a conference call, they can’t do any of those things simultaneously unless DSLs bandwidth is used with an ISDN line” (Morri, 1998).

Pricing is another issue. DSL is currently being hyped as a cheaper alternative to ISDN. However, additional research shows just the opposite. ISDN prices have been driven down due to this competition. For example, residential ISDN from Pacific Bell is around $31.65 a month. Centrex ISDN goes for $39.40 a month and Microsoft Network offers ISDN at $19.95 a month (Morri, 1998). “Basic DSL service operation at 144 Kbps usually can be found for a $1,000 installation, which includes the DSL equipment at the customer site and $150 per month for ongoing charges” (Robles, 1998).

“DSL should not be considered a cheap way to provision a business-critical service. If a small business depends on Internet access, it should not depend on a DSL solution. DSL is a great low-cost solution, however, only for a small business that wants high-speed Internet access and can tolerate rare outages of a day or two” (Robles, 1998).

Lastly, “there are legitimate technical concerns with DSL technology such as interfering data services, slowed data transfer over long distances and DSL availability are all potential problems that IT managers must consider in a potential decision to deploy DSL. Despite these potential shortcomings, DSL continues to prove itself as a legitimate means of remote access (Patton, 1998). Also, ISDN is not to be left out. “ISDN will have an extremely strong and complementary role with a number of technologies like DSL and frame relay” (Morri, 1998).

Conclusion

ISDN started in the 1980s and has been slow to catch on. In the world of dogs eat dogs, ISDN is fighting back. “End users need high-speed Internet access now, and telcos are turning to ISDN to satisfy that demand. Yet carriers officials are taking pains to explain that ISDN can coexist with other high-speed services by serving unique market needs” (Morri, 1998).

In retrospect, there may arise a hybrid version that becomes the standard connection for the last mile. For example, ISDL can not be ruled out. There appears to one very distinct advantage of combining ISDN with DSL. “It showed no degradation in throughput for all but one impairment in the raw BLAST tests. IDSL was superior with live application traffic. Latency was also rock-solid across all impairments: 17 microseconds for 64-byte payloads and 139 microseconds for 1,024-byte payloads. These numbers suggest IDSL would be a good choice for applications that demand predictable response times” (Patton, 1998).

As the introduction story tells, waiting is not an option anymore with consumers. “While the market for high-speed data among smaller businesses, telecommuters and home users is undeniable, these groups are particularly cost-sensitive. Early forays by carriers with high-priced ISDN services is one example of why it’s not enough to have a cutting edge technology. Pricing is key” (Mason, 1998). Thus, it will continue to be a battle to the end

for ISDN, DSL or any other upcoming new cutting edge technology to become the de facto standard of the last mile.

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