Connecting to the Future at MIT: The Effects of ISDN on Remote Online Searching

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CONNECTING TO THE FUTURE AT MIT: 
THE EFFECTS OF ISDN ON REMOTE ONLINE SEARCHING

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Malbeno de teknologio estas gia kutimo de peni plibonigo kio gi jam faras preskau perfekte. Rezultato: Kio estis simpla farigos malsimpliga. Plibonigo de nova telefonasistemo, por ekzemplo, kutine gi faras plu malsimplige al uze telefono ol gi estis antaue plibonigo okazis.

We begin our remarks in Esperanto, the artificial language invented to ease communication among peoples of diverse native languages, to make a point. Esperanto is a wonderful idea. It is standardized and it is neutral, i.e. it is not partial to one country or language group. It is a communications mechanism designed to be easily learned and intended to be universal. The only problem with it is that, in spite of its ease of use and a presumed need for a common international language, very few people actually understand or speak Esperanto--only about a million in the entire world. In case you are not one of those one million, what we quoted was:

The curse of technology is its habit of trying to improve what it already does almost perfectly. The result: What was once simple becomes complicated. The improvement of a new phone system, for instance, typically makes it more complicated to use the phone than it was before improvement occurred.[1]

There are parallels with ISDN, an acronym that stands for Integrated Services Digital Network. As its name implies, ISDN is an emerging telecommunications system that simultaneously supports formerly disparate media--voice, data, images, video, fax, etc. over a single broadband network. An integrated digital network is a great leap forward in the history of communications. ISDN means that phone lines can carry a conversation and data on the same wire, which provides benefits such as not needing separate modems or voice messaging machines. It also means that information can be conveyed with much less distortion and at enormous rates of speed. To give an example, a 100-page document, which might take almost half an hour to transmit with a typical fax system, can be sent in less than 20 seconds over ISDN lines. Multi-tasking is possible; for example, an online searcher can conduct a phone conversation with someone over the same line that is downloading or retrieving information.

ISDN has been technically standardized since 1984, when the International Consultative Committee for Telegraphy and Telephony (CCITT) paved the way for the new technology.[2] As with Esperanto, the hope is that it will eventually be ubiquitous and universal, providing an international highway for end-to-end digital communication. But it is not yet universal.

Although analog networks have been compared to dirt roads vs. the superhighways of digital networks, most countries still use analog lines for voice transmission. (And most countries still have at least a few dirt roads!) Analog lines are also used for digital data transmission for such activities as online searching, but this requires modems (modulators/demodulators) to convert the digital signals into tone pulses for transmission over the phone lines. Analog lines traditionally have a great deal of distortion and are limited in their bandwidths, so that data transmissions have been kept to lower speeds--typically no higher than 1200-2400 bd.
ISDN has been under development in a number of countries for the past decade. Europe has been particularly active in ISDN deployment, with France being perhaps the most ISDN-sophisticated country in the world. France Telecom's NUMERIS system, the commercial name of its ISDN system, began in 1987 and provides banking, database, and shopping services for subscribers.[3] In partnership with the French Ministry of Education, it also provides document delivery services for public libraries using Group IV facsimile. Other continental European countries, Great Britain, New Zealand, Australia, and Japan are all developing ISDN services, which in some cases are quite well advanced, with leadership and long-range planning provided by a central government agency.

In the United States, widespread implementation of ISDN services has been somewhat delayed because of the fragmented nature of our telecommunications industry. Before being broken up by the U.S. Department of Justice in 1984, American Telephone and Telegraph (AT&T) was a regulated monopoly much like France Telecom or Japan's Nippon Telegraph and Telephone (NTT). Since divestiture, the 22 local exchange carriers are individually held by one of seven regional holding companies, known as RBOCs or, informally, "Baby Bells." In addition to these we have a number of competing private long-distance companies, such as AT&T, MCI and Sprint. So instead of having a national standard for ISDN, or a coherent plan for its deployment, we have many different versions of ISDN in different parts of the country, with different time lines for implementation. The result is what is often referred to as "islands of ISDN," whereby a metropolitan area, hospital, business organization, or university implements it for internal use, but can't use ISDN to communicate with sites in the same locale, state, or across the country. In time, these islands will grow into a mainland, but for the moment there are said to be over 150 unique sites that have implemented ISDN in this country.

In 1988, MIT became one of the earliest—and at that time the largest—"island" in the United States, with the replacement of its antiquated telephone system by AT&T's state-of-the-art 5ESS voice/data telecommunications switch and software. This brought with it ISDN capabilities, providing new telephone equipment, higher data communications speeds, decreased costs, and other features, such as internal access to a campus modem pool (more about that later). It was also in keeping with the Institute's mission of being in the forefront of technological advances. ("Inventing the future at MIT" is almost a campus mantra.) As Mort Berlan, head of MIT's Telecommunications Office, wrote at the time:

The 5ESS shall allow us to grow gracefully over time—coupled to the growing introduction of digital facilities and services throughout our national and private networks—enabling the MIT community to communicate with its peers throughout the world, to access information sources that are remote from MIT, to conduct computing and other transactions as needed—so that scholarly resources appear to be attached to one universal worldwide network.[3]

This was a three-year, $21 million project, requiring an extensive rewiring of the campus and the replacement of 3000+ traditional telephone sets. The new equipment—a hybrid instrument, part telephone, part terminal, and part programmable software, each of which cost $750—still resembled a standard touchtone phone (but with more buttons and features) and still provided plain old telephone service (POTS, in telecommunications jargon), while at the same time offering many of the capabilities of a computer. Among the approximately 150 unique features now available through this superphone were: identification of the calling party/call screening; simultaneous voice and data communication; automatic redial; message light; speed dialing; voice store and forward; and internal intercom. (While some of these features were available on the old system, they incurred costs that are not now charged.)
In addition, with the standard equipment of an RS-232 port on the back of each phone instrument and internal memory chips, the new telephones carried digital data as well as voice messages on the same line; they moved data at high speeds; and because a digital phone was allotted to every student, professor, and staff member on campus, we were presented with a virtual internal network. It sounded like nirvana.

But implementing ISDN at the Institute added a level of complexity to people's lives and required many adjustments, both technical and psychological. As Machiavelli wrote in the 16th century, "There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things."

In order to prepare for cut-over day, a massive training effort began on campus. Formal classes explaining the use of the new system and instruments were given by AT&T, and documentation arrived in our offices by the cartload. It was particularly stressful for administrative support staff, who, on Day One, for example, had to know how to transfer calls, a task that had previously been handled through a central switchboard but that now required local expertise. Grumblings around campus were pervasive. What ISDN really meant, some said, was "Innovations Subscribers Don't Need," or, if lucky, "I Survived the Digital Network."

In the Libraries, where technostress had been rampant for years due to the introduction of various online services, CD-ROMs, an online catalog, as well as other OPACs, the campus network, and a variety of software and hardware, this added yet another challenge. We were soon aware that some information-related activities had immediately become more complicated, and we didn't always seem to be "growing gracefully."

We are going to speak about one of those activities: the use of online searching of publicly available databases. We are referring to remote commercial databases, or databases external to the MIT campus. The largest and most comprehensive of these database systems in the United States is Dialog Information Services, used throughout the library system. We also access STN, Orbit, Nexis, BRS, Dow Jones News Retrieval, and other systems, but to a lesser extent than Dialog.

The MIT Libraries, and more specifically the Computerized Literature Search Service (CLSS), which we are representing here today, use these services very heavily. CLSS is a centralized service point for extensive online searching in the MIT Libraries. At the time, the two searchers in CLSS typically would log on to one or more of these online services ten or fifteen times per day, spending anywhere from a couple of minutes to several hours at a time connected to a remote service. Quick reference searching is also performed at the reference desks of the individual library units in response to patron and staff needs. These logons usually encompassed less time than typical CLSS searches, but they were often more frequent. "Logging on" to a remote information service in all sites was of course accomplished in the time-honored way: with a telephone and modem.

As soon as orientation began for the implementation of the ISDN system (a year ahead of changeover day), librarians realized that the deployment of the digital phone system would affect our online searching. All existing telephone connections were to be rendered inactive on the changeover date and we would then have to rely on the new phone lines for all activities, including online searching. The new system would carry two different types of lines: analog and digital. The new analog phone lines used the same technology as the previous phone system, but the actual lines were replaced with brand new ones which would be recognized by the total system. Analog lines would behave similarly to the older system, only more reliably. The digital phone lines, on the other hand, were what the ISDN system was all about: these were the
lines that would transmit digital data and voice simultaneously on the same lines, at high speeds.

Now, what's wrong with this picture? Although we now had the capability of internally passing data back and forth from computer to computer through our telephone sets on campus without conversion and at high speeds, the off-campus networks which we needed to access did not have that capability. Dialog still sent its digital data out through modems over packet switched networks, where it was carried and delivered in analog signals via non-ISDN telephone lines leading into MIT. It then needed to be converted back into digital form to be received by our computers. Instead of that happening at each desktop equipped with a modem, it would now be performed at a central gateway on campus via the multi-user modem pool. Any data transmission calls (using the digital phone) to off-campus locations would be routed out through the campus modem funnel. An additional layer had been added to the online telecommunications process.

To prepare for these changes, we questioned technicians from our campus telecommunications office about telecommunications software that would be compatible with the modem pool. We received the assurance that many software packages had been tested and found to work, including the well-known ProComm. We specifically asked about DialogLink, the specialized communications front end software that was used at the reference desks and in CLSS because of features that encourage cost-effective searching. This package, however, was totally unknown to our consultants. We suspected at that point that DialogLink might not be supported by the new modem pool, and we were fairly certain that resolving any incompatibilities for a relatively small handful of librarians would not be the top priority of the telecommunications team on changeover day. So the Libraries made what turned out to be an eminently sensible—if conservative sounding decision: instead of ordering only the new digital lines, we decided to order analog lines also for all online service points. This cost twice as much money, but, we thought, this would ensure that regular reference desk service would not be interrupted, while it would still provide the opportunity to experiment with the new system in the relative peace and quiet of our offices. In essence, we chose evolution rather than revolution.

We were right in our decision! In CLSS we also continued to search via analog lines while attempting to figure out how to use our DialogLink software with the new digital lines. As soon as we managed this, we reasoned, we and the rest of the library system could take advantage of the benefits the new technology could bring us. We conferred yet again with consultants from the Institute's telecommunications office and information systems department, and with technical personnel from Dialog. This whole process took several months, due in part to the fact that DialogLink is a "locked" program. That is, it is a front end that, once configured, makes the instructions of how to dial and log in to the service invisible—and inaccessible—to the user. With effort from all, however, we eventually succeeded in writing macros and installing them into the basic configuration screen for DialogLink. We were less successful in configuring automatic logon to other online services, due to the fact that DialogLink's configuration space for added services is too small to contain the macros necessary to dial through the additional layer of the modem pool for automatic dial-up and because our motivation was not as strong.

At long last we began to experiment with the modem pool with our preferred communications package. Our first problem was to deal with the fact that the modem pool was not Hayes-compatible. Then we encountered mysterious problems with garbled characters, and even worse, large chunks of missing text. Our beleaguered telecommunications consultants were at a loss for an explanation until they brought in data monitoring machines and devised specialized instructions to program the phones. During this period, we increasingly fell back on the analog lines when doing extensive downloads and searches. Later
on, the situation stabilized, but these early days left us thinking that ISDN could well be an acronym for "I Still Don't Need It."

Although the Libraries weathered the changeover rather well, none of us had taken into account in our focused planning what was happening at the rest of the Institute—and in the online world—and how it would impact us regarding bibliographic instruction. Since the Libraries do not have one central classroom for user instruction, and since virtual space is more prevalent at MIT than actual, physical space, our policy has been to go to users' offices, laboratories, and classrooms to teach about library and information resources. Often online demonstrations are incorporated into these instructional sessions. But suddenly librarians found themselves prevented from providing online demos in remote sites because there was no longer access to the "right" kind of phone line. Few, if any, of the faculty and researchers requesting instructional sessions had foreseen the effect that substituting a digital line and adding a modem pool would have on connecting to outside information services.

As time went on, we in CLSS began to get plaintive phone calls from members of the community who had personal accounts with NEXIS, Paperchase, and other vendors, and now had problems re-establishing their connections through the new phone system. To a person, they had joined the communications revolution and dutifully replaced their analog lines with the digital ones, and found themselves stranded by the erratic modem pool or local front-end software which the new system would not support. We helped them as best we could, and were particularly effective in determining where in the information chain the incompatibility resided, but I believe that we could have been more effective information counselors to end users had we ourselves been more comfortable with the new telecommunications system during that start-up phase.

This story has a happy ending, however. By now, a few years later, we are at long last enjoying some of the advantages of ISDN. We have moved beyond the stage where we feel that "It Still Does Nothing." Some people use their phones and a computer for accessing the campus network, our own Barton online catalog and other catalogs, the Internet, and for e-mail. Librarians can search Dialog directly from any location, not just the reference desks, for collections work or other professional use. We now have the capability of sending files of search results directly to on-campus users without printing them on paper or transferring them to floppy disks. We can be conducting a search with our computer and simultaneously be connected by voice to a vendor's help desk or a remote user—without using two separate phone lines.

We also look forward to a time in the not too distant future when many of our remote online resources will be accessible through ISDN lines. This will provide faster transmission speeds, so we can reduce the time spent downloading abstracts and full text (or perhaps spend the same amount of time but download more!). That time is not very far off. Only this April, for example, Mead Data Central, publisher of NEXIS/LEXIS, became the first of the commercial online vendors in this country to make searching available via ISDN. The hook up, available to users of Illinois Bell, one of the regional RBOCs, enables subscribers to access the service without modems and at 9600 baud. Just two weeks ago, I spoke with a librarian from an elementary school in North Carolina, who, in the fall, will be teaching online searching to her primary school students using ISDN lines.

The wider deployment of ISDN over the next decade will have a tremendous impact on the way librarians will be able to retrieve information and provide service. When database services add these features to their files, we will be able to download patent diagrams, newspaper pictures, journal charts and graphics—the current "missing link" in full text delivery. And ISDN is said to be only the precursor of still wider-band networks (B-ISDN), with virtually unlimited capacity to transmit and receive bulk data, high fidelity audio,
high resolution images of all kinds, moving pictures, and hypertext. It will
doubtless radicalize our ideas of access and ownership.

But for those of you whose institutions have yet to implement even the "plain
vanilla" version of an integrated digital network—though they will—we leave
you with a few recommendations which we've learned the hard way:

1. Work actively to ensure that your staff is prepared for the
change, both technically and psychologically. Remember that you
are suddenly replacing one of the "easiest" pieces of technology
to use—one that we all are confident that we have mastered.
Don't underestimate the shock when you discover that you haven't.
Re-read those articles on technostress!

2. Perform an "online audit": determine who in your organization
accesses remote online services, which vendors they use, which
communications software they use, what patterns of search activity
they follow, and how much money and time they spend doing it.

3. Insist on early orientation with technical telecommunications
staff and attention to your special needs. Work with them to set
up procedures for the transition for yourselves and any end-users
you've identified who will be impacted.

4. Be aware that an ISDN network requires more sophisticated
technical support and that it may take some time before an
extensive internal structure is in place; remember that the
telecommunications experts in your organization are themselves
undergoing a learning curve and won't have all the answers in the
beginning. Be patient; be kind.

5. Make haste slowly. Don't be afraid to be conservative. Try
to hang on to some of your old phone lines and equipment as a
backup until the situation stabilizes.

6. Consider carefully which software and services you might need
to change, and recognize that your search habits will probably
change in the short term and also in the long term. Some
compromise will be necessary.

7. Try to keep a sense of perspective, remembering that, as with
the introduction of any new technology, short-term dislocations
will eventually give way to long-term improvements.

8. And finally, Bonansancon! That means "Good Luck!" in
Esperanto.

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