AD-A135 915 THE 'TIS' INTELLIGENT GATEWAY COMPUTER: AN ALTERNATIVE TO THE DDOOMSDAY SCENARIO'(U) LAWRENCE LIVERMORE NATIONAL LAB CA R K HUNT ET AL. 01 FEB 83 UCRL-88784 1/1

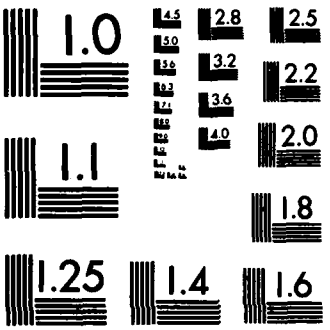
UNCLASSIFIED W-7405-ENG-48 F/G 5/2 NL

END

FILMED

1-84

DTIC



UCRL- 88784
PREPRINT

THE "TIS" INTELLIGENT GATEWAY COMPUTER

AN ALTERNATIVE TO THE "DOOMSDAY SCENARIO"

Richard K. Hunt, H. Leonard Fisher,
Viktor E. Hampel, Richard A. Kawin, Neil A. Lann

The paper was prepared for presentation to
the 4th National ONLINE Meeting at the
Sheraton Center, New York, NY
April 12-14, 1982

February 1, 1983

THE "TIS" INTELLIGENT GATEWAY COMPUTER, AN ALTERNATIVE TO THE "DOOMSDAY SCENARIO"*

February 1, 1983

Richard K. Hunt, H. Leonard Fisher,
Viktor E. Hampel, Richard A. Kawin, Neil A. Lann

Technical Information Department
Technology Information System
LAWRENCE LIVERMORE NATIONAL LABORATORY
P. O. Box 808 Livermore, California 94550

A1

Keywords: Information Management, Future, Alternatives to "Doomsday Scenario", Intelligent Gateway Computers, Downloading, Postprocessing, End Users, Team Approach.

Abstract: We describe our work experience in the Technical Information Department (TID) with the Technology Information System (TIS) at the Lawrence Livermore National Laboratory (LLNL). Contrary to the "Doomsday Scenario" postulated for information workers by Dennis A. Lewis, we find that physicists, chemists, biologists, and engineers in our highly computer-oriented work environment show interest in conducting their own searches occasionally, but prefer the information specialist to provide the routine and complex searches required for their programmatic, interdisciplinary work. Requests for information now include also factual data and oblige us to retrieve them from several different sources, some of which are overseas. To respond in a timely manner, we have started to use the Intelligent Gateway Computer (IGC) facilities of TIS. They permit automated access of major information centers worldwide, downloading, and postprocessing of retrieved results, where permissable. Postprocessing includes text analysis, graphical display of statistical interpretations, and online concording of bibliographic citations from the Department of Energy Technical Information Center (DOE/RECON). We also have started to use electronic mail to communicate our results to the end user and to discuss new searches during execution with the requestor via TIS by audiovisual means. This permits the creation of topical, subject-oriented datafiles, their online review for relevancy, annotation with numeric data and commentary, and the direct production of computer-generated master copy of cross-correlated indexes for printing. The extraction of scientific and technological intelligence is of particular interest and promise. Our information specialists are starting to work as a team with the R&D staff and contribute to the development of innovative tools in information management.

/

*Work performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under contract number W-7405-ENG-48.

1. INTRODUCTION

In 1976, Dennis A. Lewis made the following prediction at a conference in London, organized by the Institute of Information Scientists and Aslib, when he was asked to address the topic: "The Information Worker: Identity, Image and Potential".

> "In the year 2000, with the worldwide communications networks available which will provide universal rapid access to the substantial majority of required knowledge, the information scientist and the librarian will have gone the way of the brontosaurus." (Ref. 1)

This startling statement has become known as the Doomsday Scenario. It was subsequently expanded by Lewis in 1980. The contention was made that user-friendly online systems and the continuing decreasing costs of electronic products and services would allow end users of information to carry out their own online searches by the end of this century. The traditional intermediary, the librarian, or information specialist, will have joined the fate of dinosaurs by that time, Lewis said, unless they were willing to change their ideas and their careers.

We do not share this pessimistic view of the future. We observe an exciting new era for the information specialist as a profession, exemplified by our work at the Lawrence Livermore National Laboratory (LLNL). Here, our staff of nine information research specialists is using advanced computer services to assist in the research and development (R&D) of our degreed professional staff of 4300 physicists, chemists, biologists, engineers, and administrators. We find the trend towards end user searching a transitory progression in the evolution of computerized information retrieval. It is readily apparent that end users wish to perform some of their own searches. However, it is also equally apparent that their enthusiasm quickly fades and that they require reliable, routine, condensed, up-to-date services and an information specialist as an intermediary for complex or interdisciplinary searches of databases with techniques beyond their experience. This observation is supported by others in similar work environments, (Refs. 2-5) also by Lewis who offers it as a partial alternative to the extinction of the traditional information worker.

Our prediction for the future contains an expanding role for end user searching, but it retains the information specialist intermediary in a new and crucial role. First, being familiar with the requirements of the end user, he will become the expert designer of new information systems capable of delivering better end products. Second, we foresee by the year 2000 the online information intermediary to evolve into an online consultant, an information expert, who will be called primarily when information requirements exceed the capabilities of routine automation and the abilities of the end user. Another emerging role for the information expert is that of becoming an integral member of an R&D group and to condense the retrieved results towards quicker understanding for his R&D team. This new breed of information specialists will become an actual member of the research group, participate in the research program, and provide for all the information needs of the group.

We can expect technical breakthroughs which will vastly enhance the information specialist's role as an information expert. Advanced electronic telecommunications will come of age, permitting the end user to do the simpler information retrievals himself. Intelligent gateway computers, similar to those under development on the Technology Information System (TIS) at the Lawrence Livermore National Laboratory (LLNL), will evolve in different manifestations. These gateway machines will not only serve as electronic tools to enhance the role of human intermediaries, but will also permit downloading, aggregation, and post-processing of information. Electronic mail will be used to expedite communications, disseminate search results, and conduct online training.

These new systems will closely link the information expert to the researcher, providing a continuous flow of highly-refined information for decision making, derived from the vast plethora of interdisciplinary databases. Numeric, factual data will complement the traditional bibliographic search results and provide a more useful information product. Electronic mail systems then become the vehicle for the immediate transmission of the information product to the end user for review and computer analysis. At LLNL, these evolutionary changes are taking place now. The information specialist and the end user are beginning to evolve into a team, employing the computer as a tool for automated searching of the literature, and for the analysis and dissemination of retrieved results.

2. END USERS OF INFORMATION AND INFORMATION SPECIALISTS AT LLNL

In all of the studies and speculations on the takeover of online searching by the end user, one question has never been answered. Why do the end users of information want to search themselves? Lewis and others said it was a logical step in technological evolution. (Refs. 1,2) We actually find that the majority of researchers do not want to bother with online searching except, perhaps, at the beginning of a new R&D program, or as a novelty when given personal access to outside information centers.

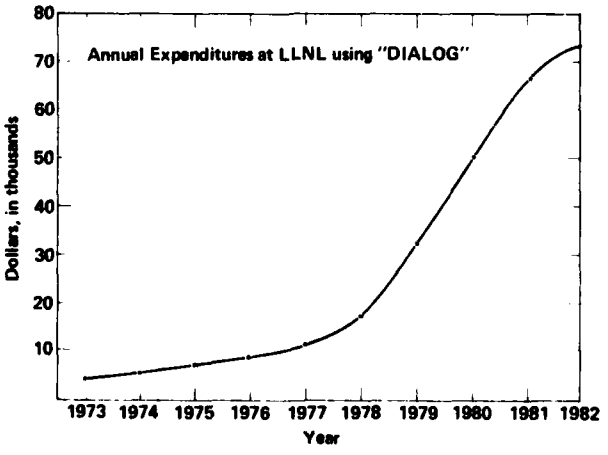
Our observation is supported by recent data from end user searching experiments. Table 1 summarizes the end user envolvement in some recent studies. At Raytheon, only 30% of the end users continued personal online searching after the trial period. Although the bibliographic dial-up information services were being provided free of charge, actual system usage was low and fell off rapidly after an initial flurry of exploratory use. (Ref. 6) Kodak experienced a slightly better success rate with 55% of their users still searching at the end of the study period. The remaining 45% of the participants returned to their previous method of having an intermediary specialist perform their searches. (Ref. 7) We suspect that Kodak's higher personal involvement of end users was due largely to the fact that their group was composed of chemists who searched primarily one, large database to satisfy their information needs: Chemical Abstracts. The Raytheon engineers, on the other hand, appear to have worked more on interdisciplinary problems involving several diversified online databases, requiring different search techniques. In a third study done recently, the pharmacists and pathologists at the University of Maryland also had a 55% success rate which can be partly attributed to the limited number of databases offered to them and to their information needs which generally didn't require comprehensive bibliographies. (Ref. 8) The statistics at LLNL are comparatively very small but support our experience of working for many years with engineers and scientists in a compact high-technology, interdisciplinary, environment.

TABLE 1. END USER INVOLVEMENT IN ONLINE SEARCHING

Study	Participants at beginning of study	Participants at end of study	Success rate %
Raytheon[6]	20	6	30
Kodak[7]	15	7	55
Univ. of Maryland[8]	159	89	59
LLNL/RECON	8	0	0
LLNL/DIALOG	7	0	0

At LLNL, we have had little success with out attempts to interest the end user in direct searching on a routine basis. This is somewhat surprising in view of the Laboratory's extensive computing facilities, and the extensive daily exposure of our R&D personnel to computer technology in the OCTOPUS, and NMFECC computer networks with more than 2500 computer terminals, quite a number of local area networks, and some 700 electronic word processing stations.

The Technical Information Department library has been providing online search services since 1972, comprising the major bibliographic and factual information centers. Most of our scientists use terminals in their daily work. Indeed our project participants first came to us requesting personal access to online systems. We trained them, provided them with passwords, and made arrangements for the use of their personal terminals in their offices by direct dial-up. Yet, after an initial few simple searches, the usage dropped sharply or stopped entirely. We are led to assume that although some end users may wish to perform their own searches occasionally, the majority seems to prefer the use of an intermediary.



The underlying reasons probably are that major end users at LLNL: 1) Don't have the time to bother with routine searching; 2) don't have the patience to learn search strategies that differ with every information center; 3) are satisfied with results provided by our staff; and 4) find direct online searching too distracting from their primary R&D.

Despite the fact that most end users in our environment seem to prefer intermediaries to handle their information needs by conventional means, our staff of online information specialist is starting to make use of advanced capabilities that may well change future statistics of success rates by removing the tedium of conventional, manual online searching. The information specialist profession will necessarily change as we incorporate new computer technology and telecommunications in our work. At LLNL, we find it both necessary and exciting to explore the use of new tools in informatics.

These observations are shared by others. Charles Meadow foresees the rise of the information worker toward a higher professional level as inevitable since information workers will continue to be consulted predominantly for complex search problems that the end user is unable to handle. (Ref.2) Lancaster and Faibisoff also predict the rise of the information specialist from relative obscurity in the R&D program to one of prominence. Indeed, automation is expected to take over routine tasks leaving the really innovative work for the new generation of trained information experts. (Refs. 3,9) Williams and Shedlock also make interesting commentary on the future of our profession. Especially Williams has shown that searches carried out by intermediary specialists are usually more cost-effective and at least as productive as those done by direct end users. (Refs. 5,10) Oppenheim, like Lewis, on the other hand, takes an extremely pessimistic view, stating that conservative elements within our profession may prevent us from "grasping the opportunities that new technology offers". (Ref. 4, p.166) The choice is clearly ours according to D. A. Lewis: "We must change or perish!"

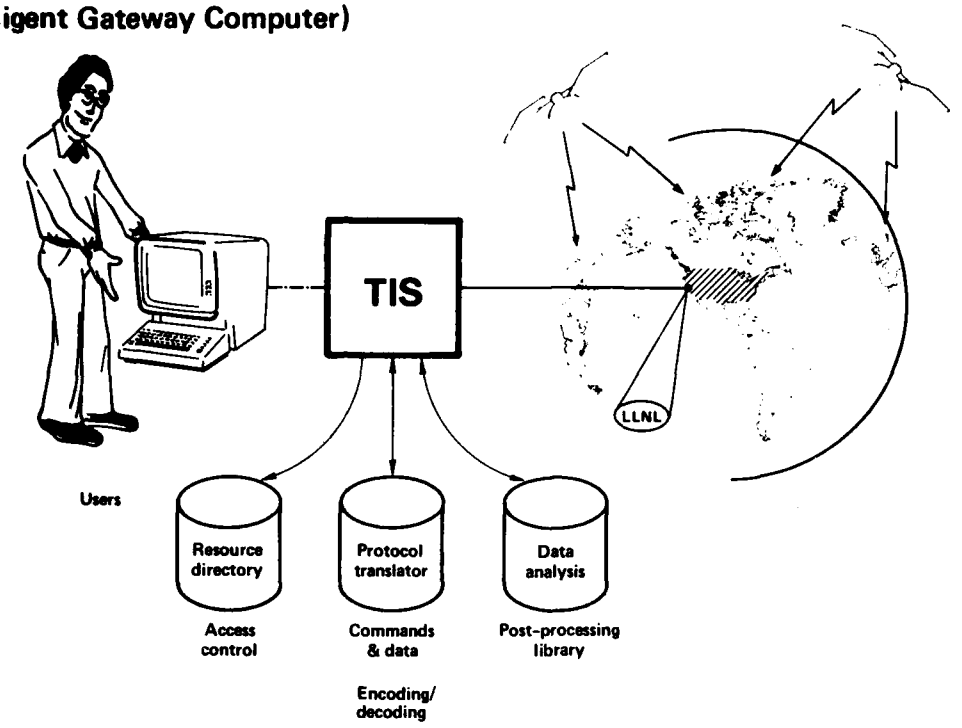
Obviously, technological innovation will aid the evolution of our profession from that of a manual information intermediary to the computer-aided information consultant. The development of computer intermediares, like IIDA (Ref. 11) and CONIT, (Ref. 12) have paved the way for increasing end user access to online systems. The next logical step in the evolution, in our opinion, is the emergence of intelligent gateway machines like LLNL's Technology Information System (TIS). These gateway computers will serve as powerful tools for information specialists and end users, working individually or as teams. Gateways facilitate automated access to large numbers of databases, downloading of textual and numeric information, postprocessing, extraction of scientific and technological intelligence, and dissemination of results by electronic means.

3. THE "TIS" INTELLIGENT GATEWAY COMPUTER

The Technology Information System (TIS) is a new-generation, dedicated information machine in operation since 1976. (Refs. 13-15) It supports several different user communities which create their own preferred view of the overall system. Internal programmatic files, models, and communications are kept on TIS. When additional information, numeric data, or computational power are needed, TIS connects to other external information centers and computers in an automated and controlled manner. Authorized users simply specify the target name of the desired resource. In addition to these shared, internal and external, resources which are organized and controlled by each program's information system administrator, each user is assigned his personal and private work space.

THE TECHNOLOGY INFORMATION SYSTEM "TIS"

(An Intelligent Gateway Computer)



The system is accessible from any telephone at 300 or 1200 baud, over the ARPA computer network and over the worldwide TYMNET system. FTS and WATS lines are provided for cost-effective use of communications and for convenience. Major capabilities are provided for TIS users in three areas: Information management, modeling, and communications. Here we mention briefly the first two, but describe in greater detail communications and networking as they pertain especially to the ongoing exploratory work of our staff from the Technical Information Department with the Intelligent Gateway Computer on TIS.

3.1 Information Management

The TIS offers the traditional database management procedures for textual and numeric data, but, in addition, TIS has the capability of direct database creation by its users without programmer intervention. This permits the use of TIS as an extension of the yellow note pad, or desk calculator.

Analysis, synthesis, and post processing of information and data are needed to increase productivity and to transfer technology. TIS gives this capability to each user. He can define and create his own view of personal resources, e.g., data files, reports, graphs, and communications by activating self-guiding and reasonably forgiving, menu-driven routines. Initially, the results of any work belong to the user/creator alone and are kept in his work space. It requires a permit command to share the data or graphic displays with someone else, a group of co-workers, or to release them for common use through the information system administrator to the TIS general user community. Since much of the daily work in R&D is being documented on electronic word processors (WP), we also established the capability of linking with several of these machines for transfer of information and data to and from TIS in the TTY-equivalent mode. In some cases, we converted WP files in their internal format.

3.2 Interactive Modeling

The execution of simulation models for performance prediction of energy systems, or for technical and economic analysis, can be carried out on TIS interactively or in the batch mode, in three ways:

First, the model may reside on TIS, which controls its input and output. Second, the model may reside on TIS and be activated by TIS, but with prompting carried out under model control. This is usually the case for models transferred to TIS from other centers. Third, the model may reside on another computer elsewhere in the country, but is controlled by TIS with regard to input or output.

Several statistical and graphical analysis routines are available on TIS. We make use of fully self-prompting routines to draw general scientific graphs, bar charts, pie charts, and milestone charts for administrative purposes. Graphs can be prepared in color as hard copy or directly as viewgraphs. Once created and named, the resulting format files can be released for use by others elsewhere, disseminated by TIS electronic mail, and printed nearly instantaneously cross-country on compatible equipment.

3.3 Communications and Networking

Effective communications are essential for information transfer among co-workers, information specialists, and end users, some of whom may work in different time zones. TIS offers the following capabilities:

o Comment is a self-prompting routine to send messages to the system administrator. The write command permits a diascript between two users logged in on TIS. Electronic mail serves the entire user community, has voting options, conferencing, and the joint preparation of reports. Interconnection with word processors permits the transmission of letters and reports via TIS electronic mail.

o The connect and dial commands permit access and use of other information centers and computers in an automated and controlled manner. At the present time, we have provisions for access to some 30 other centers, thus multiplying the information content and capabilities of TIS. Each external resource is qualified online by a listing of its available resources, examples of its command language, and uptimes.

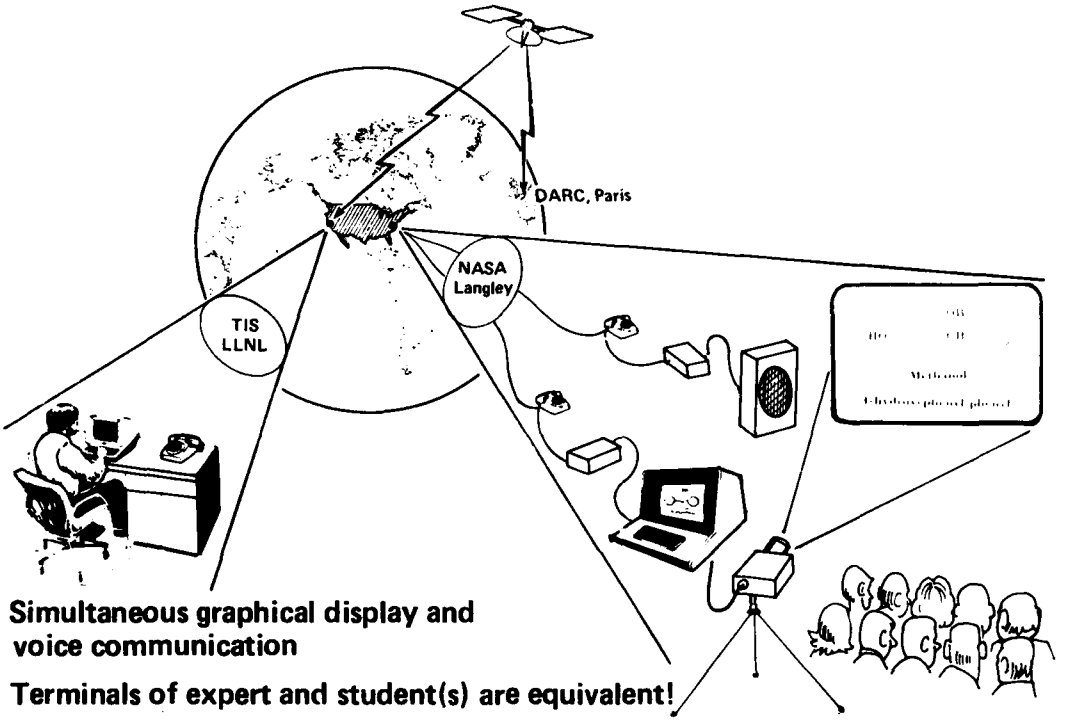
To connect to DOE/RECON, for example, the user simply specifies the target by requesting: connect doe-recon. In some cases we activate at the remote host the needed resources immediately, in which case the target name is made identical to the resource, e.g.: connect macsyma, at MIT.

o The link command can be used for online training of users on TIS, for the sharing of descriptive and graphic results with others, joint editing of online reports, and as an effective means for instant personal help.

New users are commonly scheduled for an interactive session with the Information System Administrator. The linked terminals become equivalent with regard to input and output. If the student makes a mistake, the instructor can immediately correct it from his keyboard, and explain it simultaneously over the voice-phone.

TIS has also provisions for class instructions, linking one instructor with a number of users at different locations in the country, all sharing the same display and keyboards controls. When the students are at the same location, the image on the terminal screen can be shown via the Electrohome (Ref.16) data/graphics video projector on a large auditorium screen, and the simultaneous voice communications can be amplified over a public address system for all to hear.

DEMONSTRATION OF "DARC" BY ISOM HARRISON TO THE NASA/RECON USER'S COMMITTEE, October 19, 1982



Simultaneous graphical display and voice communication

Terminals of expert and student(s) are equivalent!

This procedure was last used successfully during the recent NASA/RECON Users' Committee meeting at the NASA Langley facility, October 1982. While on location, we called Isom Harrison at LLNL and asked him to give participants at Langley a live demonstration of the French chemical structure retrieval system, DARC, in Paris. We linked our terminals, connected to DARC, and heard Isom's explanations over the public address system which was linked to the voice phone through an inexpensive voice switch from Radio Shack.

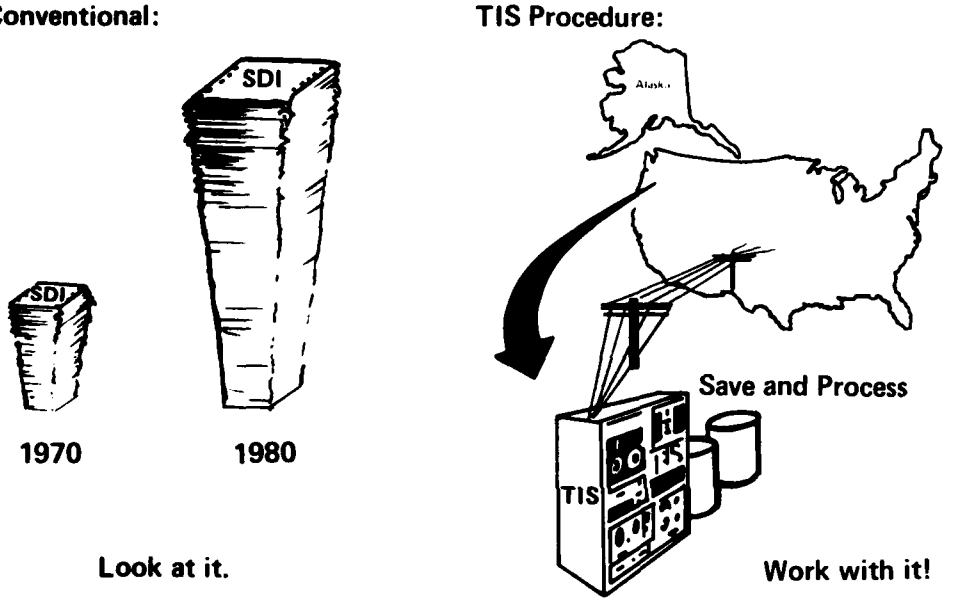
3.4 Extraction of Intelligence - The Real Payoff

Facts, by themselves, do not convey understanding or knowledge. Their comparison with past experience, correlation with other data and/or predictions, and display in multidimensional color images are required for learning and decision making. However, Federal and commercial bibliographic online information services are still delivering most of their citations to the end user as printouts.

The integrated Technology Information System offers online, interactive commands for post processing immediately after completion of a search. A cogent example is our work with the DOE/RECON information system. Citations retrieved can be downloaded into a file on TIS, aggregated, and processed interactively for the immediate creation of indexes by category, keyword descriptors, and author, or printed as topical concordances with text analysis. Any bibliographic field element can be cross-correlated with any other.

Where required, citations can be complemented with key-to-disk annotations about their user-defined relevancy and ranking. Requests for full-text copies can be issued at this time. Citations can be augmented with numeric or descriptive data derived from the reports. Publication statistics can be shown graphically, online, and enhance further the insight possible from the retrieved information. This opens new vistas for extraction of higher intelligence from descriptive text in science and technology. (Ref. 17)

POSTPROCESSING OF BIBLIOGRAPHIC INFORMATION

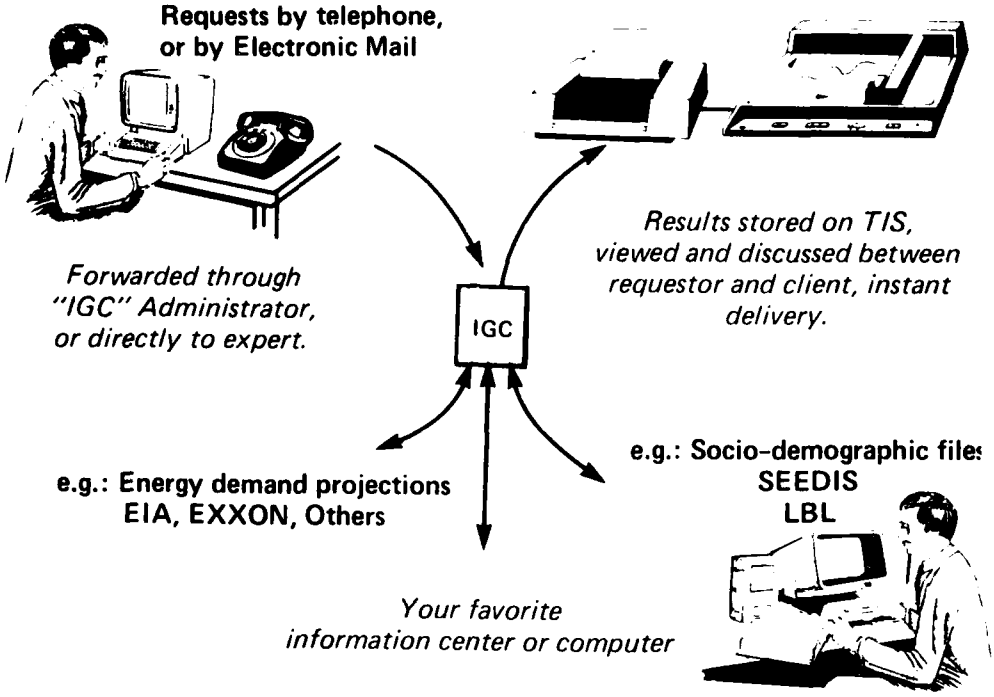


3.5 Use of the Intelligent Gateway Computer as an Intermediary to Technical Information.

Audio-visual linking of users across nations and continents suggests a new application of the TIS/IGC as an electronic intermediary between requestors and vendors of technological information. It will probably be more efficient for the infrequent information center user to unburden his mind with requests for technical information by asking a staff assistant or secretary to send the requests by electronic mail or, even better, to dictate them directly into a message machine.

We have implemented these capabilities on the IGC prototype by making the telephone number for the message machine reserved for this purpose known to our users, by the REQUEST command and by extensive electronic mail capabilities that permit us to forward and answer mail, including reports and graphs, in an automated manner. We envision increased use of this capability in future months by forwarding such requests through the TID information consultant to the information experts, and the appropriate annotations concerning the delivery time and the requestor's willingness to pay. The results would then be returned to the requestor's IGC mailbox, for joint audio-visual discussion with the expert if necessary or for immediate printing at the requestor's terminal. The TIS Intelligent Gateway Computer will thus become the electronic intermediary between the end user and the information expert.

"IGC" – A PRACTICAL INTERMEDIARY TO EXPERT INFORMATION:



4. CONCLUSION

Dennis A. Lewis clearly foresaw five alternatives to his postulated demise for the information worker: Training, Marketing, Intelligence, System Design, and Information Brokerage. Today, these alternatives still pose a challenge but are rapidly gaining acceptance worldwide. Tomorrow, they will be choice opportunities for those entering the information field.

Information is power. It is the ultimate weapon in our competition among each other as professionals, among industries, and countries. But, worldwide availability and use of information also brings new hope for mutual understanding and peace. Communication satellites are starting to remove the political barriers, geographic distance, and time. English, by the sheer power of our country to measure and publish more than half of all data in science and technology, has become 'de facto' the universal information language in the world. The forthcoming Japanese national information network for science and technology chose English as the communication language, and Japanese S&T publications are indexed in English to be in step with the large body of Western know-how. Some European countries have found it prudent to do the same.

We need not be afraid of other countries making use of our information. But, we should make every effort to use it ourselves first!

References

1. D. A. Lewis, The Information Worker: Identify, Image and Potential, Proc. Aslib/Institute of Information Scientist, 1977 M. R. Raffin, R. Passmore (Eds.), pp 38-49.
   Lewis, D. A., "Today's challenge-tomorrow's choice: change or be changed or The Doomsday Scenario Mk 2," J. Inform. Sci., Vol. 2, pp 59-74. 1980.
2. Meadow. C. T., "Online searching and computer programming: some behavioral similariites (Or.... why end users will eventually take over the terminal,) Online, Vol. 3, pp 49-52, 1979.
3. Lancaster, F. W.; Drasgow, L. S. & Marks, E. B., "The role of the library in an electronic society," in Lancaster, F. W., Ed. Clinic on Library Applications of Data Processing, University of Illinois at Urbana-Champaign, April 22-25, 1979. Urbana-Champaign, Il: University of Illinois, pp. 162-191, 1980.
4. Oppenheim, C., "Technology and the information professional: will it make a difference," Inform. Serv. Use., Vol. 1. pp. 161-167, 1981.
5. Shedlock, J., "Looking down the road: end user searching, "Med. Ref. Serv. Quart., Vol. 1, pp 61-65, 1982.
6. Richardson, R. J., "End user online searching in a high-technology engineering environment," Online, Vol. 5, pp 44-57, 1981.
7. Haines, J. S., "Experiences in training end user searchers," Online, Vol. 6, pp 14-23, 1982.
8. Teitelbaum, S. & Sewell, W., "Survey of attitudes of pathologists and pharmacists forward nonmediated online searching," in Petrarca, A. E.; Taylor, C. I. & Kohn, R. S., Eds. Proceedings of the 45th ASIS Annual Meeting, Columbus, Ohio, October 17-21, 1982. White Plains, NY: Knowledge Industry Publ., pp 298-300, 1982.
9. Faibisoff, S. G. & Hurych, J. "Is there a future for the end user in online bibliographic searching?," Spec. Libr., Vol 72, pp 347-355, 1981.
10. Williams, P. W. "The role and cost effectiveness of the intermediary," in First International Online Information Meeting, London, December 13-15, 1977. Oxford: Learned Information, pp 53-63, 1977.
11. Meadow, C. T., Hewett, T. T. & Aversa, E. S., "A computer intermediary for interactive database searching. I. Design," J. ASIS Vol. 33, pp 325-332, 1982.
12. Marcus, R. S. "User assitance in bibliographic retrieval networks through a computer intermediary, " IEEE Trans. Syst. Man Cybern., Vol. 12, pp 116-133, 1982.
13. Hampel, V. E., Cain, J. B., Kawin, R. A., Pavel, G., Lann, N. A., Richards, G. T., and Scott, W. S., TIS - A Focal Point for Technology Transfer, UCRL-53342, September, 1982.
14. Hampel, V. E., Fact Retrieval for the 1980's, Technical Information Panel (TIP), NATO/AGARD Conference, Munich, West Germany, UCRL-85749, AGARD-CPP-304, 1981.
15. Hampel, V. E., Gallo, L. E., Kawin, R. A., Kopytoff, V., McGrogan, S., O'Connell, L. G., Pavel, Schriebman, J. A., Swanson, J. E., Editor, Proceedings of the First DOE/LLL Workshop on the Technical Managment Information System (TMIS), CONF-791258, 1979.
16. Electrohome Data/Graphics Video Projector, EDP-57, Electrohome Limited, 809 Wellington Street North, Ketchener, Ontario, Canada, N2G 4J6.
17. Harrison, I., Jr., Hampel, V. E., Kawin, R. A., Downloading and Post-processing of Bibliographic Information with the TIS Intelligent Gateway Computer, prepared for submittal to Online '82 Conference, Atlanta, GA, Nov. 1-3, 1982, UCRL-88119.


FILM
1-8