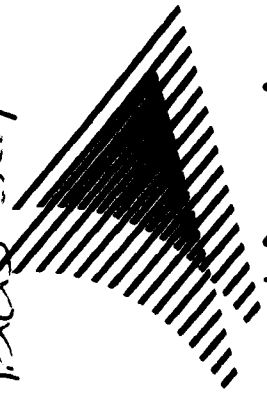
DTIC/TR-89/5

AD-A203351

NEW

AD-A203 351



DAITC

The DoD Gateway Information System (DGIS): The Department of Defense Microcomputer User's Gateway to the World

DAITC/TR-88/010

Allan D. Kuhn
Gladys A. Cotter

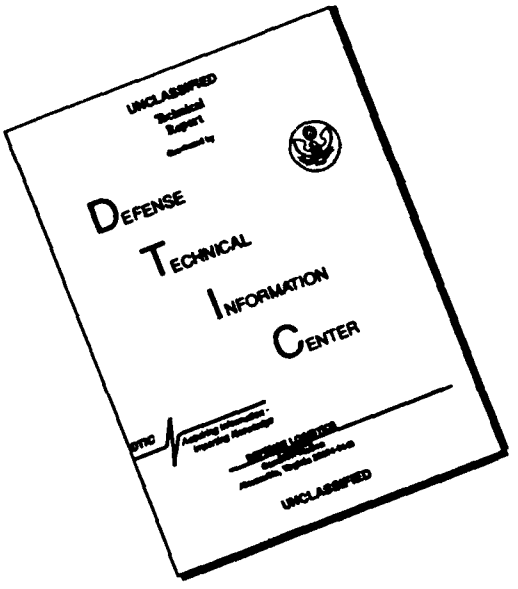
File Copy

June 1988

Defense Applied Information Technology Center

1800 North Beauregard Street
Alexandria, Virginia 22311
(703) 998-4787
Fax No. (703) 931-3968

DISCLAIMER NOTICE



THIS DOCUMENT IS BEST QUALITY AVAILABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

UNCLASSIFIED
ECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b RESTRICTIVE MARKINGS
2a SECURITY CLASSIFICATION AUTHORITY	3 DISTRIBUTION / AVAILABILITY OF REPORT Approved for public release; distribution unlimited
b DECLASSIFICATION / DOWNGRADING SCHEDULE	
4 PERFORMING ORGANIZATION REPORT NUMBER(S) DAITC/TR-88-010	5 MONITORING ORGANIZATION REPORT NUMBER(S) DTIC/TR-89/5
6a NAME OF PERFORMING ORGANIZATION Defense Applied Information Technology Center 6b OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION Defense Technical Information Center
c. ADDRESS (City, State, and ZIP Code) 1800 N. Beauregard Street Alexandria, VA 22311-1784	7b ADDRESS (City, State, and ZIP Code) Cameron Station Alexandria, VA 22304-6145
8a. NAME OF FUNDING / SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
c. ADDRESS (City, State, and ZIP Code)	10 SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

11. TITLE (Include Security Classification)
The DoD Gateway Information System (DGIS): The Department of Defense Microcomputer User's Gateway to the World

12. PERSONAL AUTHOR(S)
Allan D. Kuhn, Gladys A. Cotter

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
	FROM _____ TO _____	8806	27

16. SUPPLEMENTARY NOTATION
Published in Microcomputers for Information Management: An International Journal for Library and Information Services, Volume 5, Number 2, June 1988, pp. 73-92

17 COSATI CODES			18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Gateways, Networking, End-users, Microcomputers, Interfaces, Hypermedia, DoD Gateway Information System, DGIS, Defense Technical Information Center, DTIC
5	2		
12	5		

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

The explosion of microcomputers is highly visible throughout the Department of Defense (DoD). These systems are sitting on the desks of managers, office staff, scientists and researchers. Microcomputers have many uses as stand-alone systems or as part of a local area network. But another highly important element is communication. Communication is needed not only to search for information on remote databases, but also to disseminate and re-disseminate information. Communication means access to the world greatly beyond one's immediate work area. The DoD Gateway Information System (DGIS) is being developed by the Defense Technical Information Center (DTIC) to provide communications access for DoD endusers. DGIS provides online streamlined methods for identifying, accessing, searching, processing, and analyzing data from heterogeneous information systems, giving access to comprehensive information to the wide variety of special interest

(continued on reverse)

20 DISTRIBUTION / AVAILABILITY OF ABSTRACT	21 ABSTRACT SECURITY CLASSIFICATION
☐ UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT ☐ DTIC USERS	UNCLASSIFIED
22a NAME OF RESPONSIBLE INDIVIDUAL Allan D. Kuhn	22b TELEPHONE (Include Area Code) (202) 274-5367 / 22c. OFFICE SYMBOL DTIC-EB

DD Form 1473, JUN 86 Previous editions are obsolete. SECURITY CLASSIFICATION OF THIS PAGE

19. (Continued)

areas in the DoD information community. To accomplish this task, DGIS is making use of a variety of hardware, software, and communications technologies that are blended and modified to make use of DGIS easier and the results more meaningful. DGIS puts the power of a centralized system into the hands of the microcomputer user, who in turn combines the power of the microcomputer with that of DGIS to cross the threshold into world information.

THE DOD GATEWAY INFORMATION SYSTEM (DGIS): THE DEPARTMENT OF DEFENSE MICROCOMPUTER USER'S GATEWAY TO THE WORLD

Allan D. Kuhn
Gladys A. Cotter

Published in
Microcomputers for Information Management:
An International Journal for Library and Information Services
Volume 5, Number 2, June 1988, pp. 73-92

Defense Technical Information Center
Alexandria, VA 22304

Defense Applied Information Technology Center
Alexandria, VA 22312

This report was prepared in the
DAITC Hypermedia Laboratory

The DoD Gateway Information System (DGIS): The Department of Defense Microcomputer User's Gateway to the World

Allan D. Kuhn
Gladys A. Cotter

Defense Technical Information Center
Alexandria, VA 22304-6145

The explosion of microcomputers is highly visible throughout the Department of Defense (DoD). These systems are sitting on the desks of managers, office staff, scientists, and researchers. Microcomputers have many uses as stand-alone systems or as part of a local area network. But another highly important element is communication. Communication is needed not only to search for information on remote databases, but also to disseminate and re-disseminate information. Communication means access to the world greatly beyond one's immediate work area. The DoD Gateway Information System (DGIS) is being developed by the Defense Technical Information Center (DTIC) to provide communications access for DoD endusers. DGIS provides online streamlined methods for identifying, accessing, searching, processing, and analyzing data from heterogeneous information systems, giving access to comprehensive information to the wide variety of special interest areas in the DoD information community. To accomplish this task, DGIS is making use of a variety of hardware, software, and communications technologies that are blended and modified to make the use of DGIS easier and the results more meaningful. DGIS puts the power of a centralized system into the hands of the microcomputer user, who in turn combines the power of the microcomputer with that of DGIS to cross the threshold into world information.

INTRODUCTION

The explosion of microcomputers is highly visible throughout the Department of Defense (DoD). These micros are sitting on the desks of managers, office staff, engineers, scientists, researchers, and all others who need to both organize their work and to communicate.

The explosive proliferation of microcomputer use brings with it an expanding population of micro users, also known as endusers. Automation of the work environment provides the opportunity to finally store information that is rapidly locatable. The microcomputer and its bigger brother, the work station system,

are also optimally used for research modelling. These activities, however, lend themselves to uses either as stand-alone set-ups or a local area network environment. But another important element is communication, not only for searching for information, but also to disseminate (and re-disseminate) information. Communication means access to the world greatly beyond one's immediate work area.

The introduction of microcomputers (or personal computers) into the office enduser environment, combined with the developing awareness in endusers that the information available online renders much more comprehensive information and therefore better decisions, played a major role in altering the earlier philosophy that the diversity of information systems permitted access only by search specialists, or intermediaries. Whereas in the market world it was realized that access to global information meant getting a keener competitive edge, in DoD global access meant acquiring comprehensive information that better satisfied the information needs of the mission of the DoD office (Cotter, 1987). The DoD Gateway Information System (DGIS) is being developed by the Defense Technical Information Center (DTIC) to provide this access to DoD microcomputer endusers, and in doing so, providing a view to those endusers that is global, rather than local.

THE DEFENSE TECHNICAL INFORMATION CENTER (DTIC)

The Defense Technical Information Center is charged with providing information services to the Department of Defense Scientific and Technical Information community. These services range from collecting and disseminating bibliographic information to sponsoring and directing research into innovative information handling technologies. Through this research, DTIC actively seeks ways to promote access to and utilization of scientific and technical information (STI) databases and online services, and networks relevant to the conduct and management of research and engineering (R&E) programs.

One of the most important efforts in this area is the development of the DoD Gateway Information System. The DGIS will provide online, streamlined methods for identifying, accessing, searching, processing, and analyzing data from the heterogeneous database universe, giving access to comprehensive information to the wide variety of special interest areas of the DoD R&E community (Cotter, 1985).

WHY DGIS?

The necessity of the DGIS springs from the burgeoning proliferation of databases containing scientific and technical information and the absence of accepted information handling standards within the industry. These factors of proliferation and lack of standards have produced severe barriers between information

seekers (in our case, DoD researchers, i.e., endusers) and the information they require.

We now have visions (or nightmares) of a mega-host of endusers (the plague of the information age?) armed with micros performing their own searching. Additionally, we know that the amount of information endusers ask for is a function of the distance from their desk to the location at which the question must be posed. In reducing the distance between desk and answer to zero, it is fairly safe to presume that this "zero factor" will have a tremendous effect on enduser information needs.

Yet, the multitudes of endusers have not arrived in great masses. Direct accessing of online information remains a highly sophisticated art. The first encounter between endusers, in their new role of doing their own searching, and the information systems universe yielded our first and highly important lesson:

Lesson One: *As a general rule, endusers, unlike information professionals, will not devote extensive time learning to use a system.*

Endusers found that walking to the library was a lot faster than learning to use a retrieval system. Because the "zero factor" was not in place under this situation, vendors and developers set out to construct the perfect user interface. The interface was to be "user seductive." A number of systems deemed "user friendly" were put on the market, with more lessons learned:

Lesson Two: *Lesson One is the only general rule that applies to endusers across the board.*

Lesson Three: *Endusers are a diverse group with many diverse needs. They require different types of data, different products and services, different user interfaces, and different marketing strategies.*

Lesson Four: *"User friendliness" is an attribute that is bestowed by the user and not an innate state of being that is created through system design.*

The current method for searching a database by use of a remote set-up (i.e., terminal, microcomputer) requires that an enduser identify and access an appropriate distant computer and follow the unique search practices that have been programmed into it. For the infrequent user, most of the time and effort expended in a search are nonproductive. They are given over to identifying appropriate databases, accessing them, reading instruction manuals, and cutting and pasting printouts. The need is for the resulting information product, which takes relatively little time to assemble. The rest of the search process is expensive overhead.

The DGIS is being developed to eliminate the unproductive portion of the search process and allow researchers to spend their time utilizing the resultant information. Our ultimate objective is to develop a system that responds to a

```
0              WELCOME TO THE DoD GATEWAY INFORMATION SYSTEM


          >>>>>>>>>>> INFORMATION TRANSFER MODULES
          1          directory          DGIS Directory of Online Resources.
          2          communicate        Connect to information resources and people.
          3          process            Information product tailoring.

          >>>>>>>>>>> INFORMATION UTILITIES
          4          em                 Electronic Mail.
          5          files              File operations.

          >>>>>>>>>>> SUPPORT INFORMATION
          6          help               Description of features.
          7          users              DGIS registered users.
          8          info               DGIS news and information.
          9          dtiolog            DGIS full text retrieval.

          DGIS HOTLINE NUMBER: (703) 276-8182
          or send questions via DGIS EM to 'dgishelp.'

Enter a menu number, a command, "b" to backup, "t" for top, or "e" to end.
•
```

Figure 1. Top menu of the DoD Gateway Information System.

researcher's information need by locating the appropriate databases, conversing with them on the user's behalf, and providing a single, final, relevant information product (Cotter, 1985). Figure 1 shows the top menu of DGIS, and shows the overall DGIS functions.

THE DGIS FUNCTIONS

To serve the enduser at the micro, DTIC initiated development of DGIS in 1983. DGIS is an intelligent gateway system that provides distributed networking, electronic communication, and information access and analysis. DGIS links people, information services, and computers. The technology embodied in DGIS provides key menus, pointers, and interoperability of systems. Also, DGIS will serve as a central point in interconnecting online DoD information systems that are eventually to form a Scientific and Technical Information Network, called STINET. To accomplish this, DGIS is to function as an electronic switch, a translator, a communication interface, and a transaction controller.

DGIS focuses on streamlining the information retrieval and analysis process. This is done by placing the micro user at the center of a vast information universe consisting of people bases and databases and providing the user with the navigational tools required to pinpoint and arrive at the desired destination. The mission of DGIS is to provide easy-to-use interfaces for identifying, accessing, interrogating, and postprocessing information from numerous databases relevant to DoD information needs.

In terms of databases, the DGIS is designed to provide users with the answers to the questions:

- What relevant databases exist?
- How do I access them?
- How do I retrieve information from them?
- What can I do with the retrieved information?

In terms of people bases, the DGIS is designed to answer the questions:

- What expertise is available on the network?
- How do I communicate with experts?
- How do I share information with colleagues?

DGIS acts as an integrated information system that allows human experts, information users, and information resources to exist and interact in harmony. Development of DGIS is a multi-year, multi-task project. A highly functioning prototype system has been developed, and is in use now by about 250 users. The basic components of the system are:

- a Directory of Resources, subject searchable,
- a common method for accessing and searching diverse databases,

- tools for downloading and postprocessing data,
- tools for communicating with a network of experts and colleagues.

DGIS is designed for a DoD user community that includes both intermediaries and endusers. Although DGIS was established to accommodate users accessing with dumb terminals, the greater part of the community is employing microcomputers in order to have the advantages and capabilities of DGIS and the micros. The user is accessing the wide range of information found in the well-known federal, commercial, and international databases and systems. Eventually many small, specialized DoD databases will be a part of DGIS access. This information will be processed by the users themselves, as explained below.

THE STRUCTURE OF DGIS

Although there are several information handling modules on DGIS, as shown by the top menu in Figure 1, the three primary modules are (1) "directory," (2) "communicate," and (3) "process."

1. Directory

The DGIS Directory of Online Resources (Jacobson & Cotter, 1986) is being developed to contain information on the content and scope of databases relevant to the interests of DoD. It is subject-searchable so that on entering the topic of interest the user is provided a listing of appropriate databases. The purpose of the Directory is to serve as a unified reference source to all Research and Development databases within the Department of Defense (Jacobson & Jarus, 1988). The first stage of the Directory is to have the references to DoD systems. Later the Directory will also incorporate references to the databases of both major and lesser information resources. While a wide range of databases are accessed, the most commonly used ones are from DIALOG, BRS, ORBIT, NASA-RECON, and DoD-DROLS.

The Directory is still in development. It is envisioned to include subdirectories with references not only to databases, but also to people and to computing resources. The Directory of People will contain references to experts in subject areas and information retrieval techniques who may be contacted via the network. The Directory of Computing Resources will contain references to resources such as supercomputing and parallel processing, which can be used for data analysis and modelling, available through the network.

2. Communicate

The very basic backbone of DGIS is its communications capabilities. As already indicated, we want communications with all resources of information, whether

they be people or databases. The second factor in communications is making sure that it is easy. The DGIS communications breaks down into two categories: passive and interactive.

The passive communication is the incorporation of electronic mail (EM). EM by now is standard in most systems, with everyone realizing the benefit of being able to leave a message, including through internetting, and eliminating telephone tag. An additional use of EM on DGIS is sending files to other users, that is, transferring knowledge quickly and conveniently.

Interactive breaks down into two additional categories: (a) communicating interactively with people, and (b) communicating with information systems.

a. DGIS includes the capability for users online to "talk" interactively with each other through the keyboard. Users may also link system accounts, one user being designated as the master account; this allows users to interact on a specific task, such as editing a file or watching a database search.

b. The major feature of DGIS communications capabilities is establishing connection agents for individual users to information systems. The connection agent completely automates the user access actions, including establishing the telecommunication connection, validating user access, and logging on to the target information system. Automated logging on includes entry of the user's logon codes; these codes are linked to the user's DGIS account, and therefore their use is prohibited to any other user.

If a connection agent has not been established, however, the DGIS user still has the option of dialing through DGIS to any system for which the user has access codes, in the same manner as directly dialing from one's terminal or microcomputer. The advantage of using DGIS, however, is making use of its information collecting and processing utilities.

A part of communicating with multiple remote systems is aggregating useful information from them. A part of the DGIS communications program, therefore, is not only accessing a remote system, but also accessing remote systems and collecting information from them simultaneously. When the user has accumulated a satisfying degree of information, that user then has the option of using the information files in their original output formats, or tailoring that accumulation into a single, unified information product through the DGIS postprocessing utilities.

3. *Process*

This third basic module of the DGIS is for reprocessing aggregated and disparate information files into a uniform product that is most useful to the enduser of that information. DGIS's current focus is on bibliographic information, and has a number of automated routines for standardizing, reviewing, analyzing, and formatting bibliographic information from the major federal government and commercial information systems. These utilities allow arranging a bibliography and any indexes and concordances deemed useful by the user for a final product worthy for presentation.

DEVELOPMENTS AND APPLICATIONS OF DGIS

Developments taking place for DGIS represent our areas of interest in making the system as streamlined and as easy to use as possible for the enduser. Although DGIS is basically functional now, it is still in prototype mode with several of its modules in varying stages of development. Examples are the Directory and the Postprocessing. Our intent is to make optimum use of current technologies. But we are also interested in emerging technologies.

A. Directory of Online Resources

The Directory development is making use of the INGRES Relational Database Management System (RDBMS). INGRES RDBMS, in making use of 4th Generation Language (4GL) capabilities, permits streamlined and unified use of native mode or menu-driven mode for searching the Directory. This is in addition to the windowing and forms query features of a 4GL system that can be made available on an otherwise ASCII-based system. Under development are an input/editing interface and a fast query/retrieval system. Directory usage goals include a flexible, well-defined system, friendly user interfaces, and smooth migration from prototype to production system.

The relational model was selected for its ease of programming, safe multi-user access, and applications portability. The INGRES package being used to develop this system provides these advantages, but lacks support for large text fields and full-text retrieval. These drawbacks are not inherent to the relational model but are common to current commercial implementations of it. Our approach has been to use INGRES tools as much as possible, and UNIX/C tools when necessary.

B. Postprocessing Utilities

The postprocessing utilities on DGIS are extensive, complex, and still under development. Although we realize that there are a number of PC-based bibliographic information processing programs, our intent is to offer the power of a large system for processing information, and in doing so hopefully also expand on processing capabilities. These capabilities include ("Gateway user support," 1987):

- translation of downloaded files into standard bibliographic format,
- merging the translated files into a single file,
- elimination of duplicate citations,
- cross-correlation of fields,
- frequency counts,
- analyses of data field use,
- preparation of detailed indexes,
- sequential review of citations,

- multiple level sort,
- citation reformatting.

C. *Interfaces*

The first interface was the menu system for the DGIS itself. The purpose (Kuhn & Cotter, 1986) of that interface was to unify all the functions of DGIS, and to step the user through those functions completely from beginning to end. These menus employ the concepts of English language commands, short-form commands, the use of those commands to invoke any function in place of following through the menus, access to any part of the menu system from any other part of the menus, and incorporating a command-continuity line at the bottom of the menu option display screens to remind the user how to move about (top, back, command, end), including an exit command to end or escape a session.

We realized very early, however, that this interface in even being the basic access to DGIS had limitations. The basic DGIS functions structure is designed primarily for DoD special and technical library intermediaries. We also wanted to serve the DoD enduser. That person could fairly easily learn the DGIS operations, but an enduser staffing an office has an office mission to fulfill, rather than dedicating multitudes of time to searching information systems. Yet, these users represented a market segment that needed to scan literature and locate relevant items in their area of interest. They needed an interface that would provide easy access to a large variety of databases, including pointers to unfamiliar databases, for information relevant to the subject rather than an exhaustive search of the subject. Examples of such information are production statistics and newspaper articles.

For this segment of the DoD community, DTIC introduced SearchMAESTRO. SearchMAESTRO is an external interface that is accessed directly or through DGIS. It provides access to over 900 databases through a hierarchical menu-driven interface, will identify or select an appropriate database for the user, and eliminates the need to know how to do database searching. SearchMAESTRO takes the user's query, sends it off to the database, and brings the results back to the user for review.

As DGIS utilization expands, we become more acutely aware of the needs of user community segments that could be accommodated with specialized DGIS user interfaces. We envision, for example, a tighter integration of SearchMAESTRO and simplified DGIS processes for the DoD casual enduser. DTIC, in being a sub-organization of the Defense Logistics Agency (DLA), the major procurement agency for DoD and military services, anticipates establishing a logistics information universe for the DLA community. There is also a very large need for business information throughout DoD, which could be accommodated with an interface that coordinates the breadth and depth of the voluminous business information scattered throughout the information universe. Along this line, we have become interested in developing or applying expert system and microcomputer-based interfaces.

DGIS STEPS INTO ARTIFICIAL INTELLIGENCE

A. Common Command Language

Our entry into AI began with our development of a common command language (CCL). DGIS is creating a CCL system to serve the skillful searcher access multiple information systems, including those with which the searcher may not be familiar. Our CCL system is based on the draft standard put out by the National Information Standards Organization (NISO, 1987).

Originally we thought CCL might be accomplished with traditional third generation programming (in this case, C language). We developed our first prototypes with DIALOG, BRS, NASA-RECON, and DROLS (Defense RDT&E On-Line System). These first prototypes made us realize that information systems as a whole represent a very heterogeneous universe. The C language prototypes, therefore, served as a study stage (Kuhn, Bixby, & Tran, 1987; Bixby, 1987) for the problems and feasibility of CCL, during which we also began looking at AI as a means to handle the complexities of information systems and their operational behaviors.

We selected PROLOG as the appropriate programming language to incorporate AI capabilities into CCL and also initiate AI-based programs into DGIS. PROLOG was chosen because of its logic programming characteristics and tools

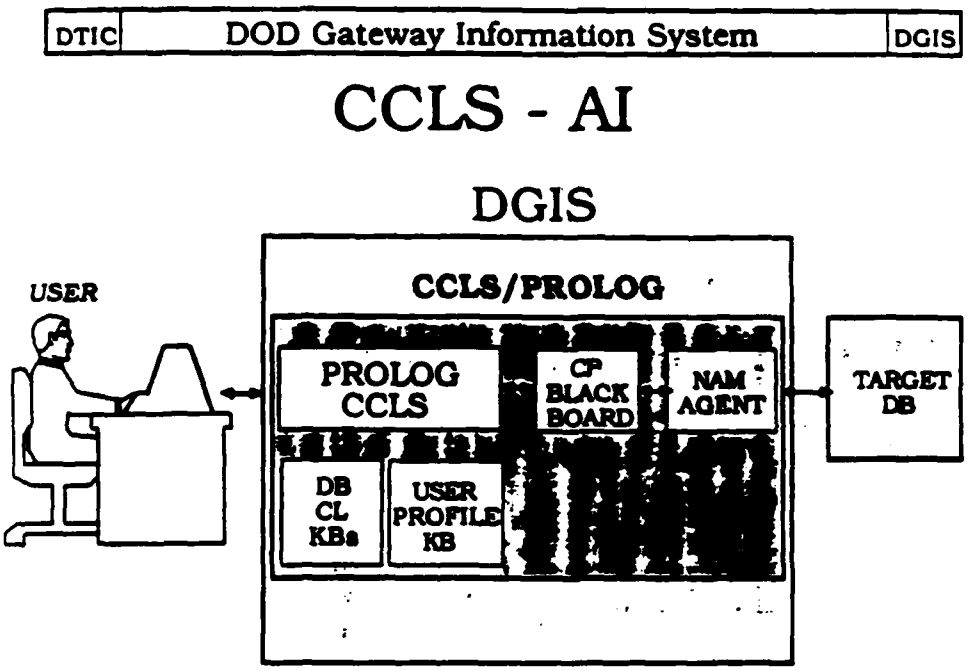


Figure 2. The Architecture of DGIS CCLS-AI.

```
DGIS/vax[1]% ccl

    *** Welcome to DGIS CCL ***

 This system is the first AI-based component
 on DGIS to give the user standard access to
 diverse information systems.

The following systems are currently available:
  dialog,brs,drols,nasa

Please specify a CCL system (^D to exit) > dialog

Trying to establish connection to DIALOG using NAM.

Attempting hardwired connection at 1200 baud to TYMNET. Connection established to TYMNET.

Attempting TYMNET connection to DIALOG2. TYMNET connection established to DIALOG2.

Attempting login. Login complete.

********
Loading DIALOG knowledge base ...

Loading User Profile Knowledge Base ... [/ai/ccl/prolog/userkb/kuim.pl consulted (0.300 sec 340 bytes)]

CCL > explain

The EXPLAIN command provides information on various topics in CCL DIALOG. The following topics
can be explained:

choose  display  find  show  stop
define  explain  general  start

CCL >  etc.
```

Figure 3. DGIS CCLS prototype: Initiating DGIS CCL. Note banner, systems available, connecting to target system in CCLS mode, login, DIALOG Knowledge Base loaded, User Profile Knowledge Base loaded, entry of NISO common command "explain" in place of "help."

such as its inherent reversibility, database capabilities, separation of logic and control, and its object inheritance and message passing. PROLOG additionally fits well with the intended plan for a gradual migration of CCL from a structured command language to natural language. The current phase of the project utilizes blackboard architecture and knowledge-based driven knowledge sources. Figure 2 illustrates the architecture of the CCL system. The "NAM agent" in the figure is the connection agent; NAM stands for Network Access Machine, which is in

reality connection agent software developed originally by the National Bureau of Standards.

Figures 3 through 7 show the actual screen dumps on how the user can sign on to various information systems through DGIS CCL. Figure 3 illustrates how DGIS CCL is initiated and how DIALOG knowledge base is accessed. Figures 4 and 5 show how "EXPLAIN," "CHOOSE," and "SHOW news" work in DOD-DROLIS. Figure 6 illustrates how a sample CCL search and retrieval session works in NASA knowledge base, and finally, Figure 7 provides a sample display of how a CCLS session is opened and closed.

DGIS CCL, therefore, is being strutured as a knowledge-based system. The control program is a blackboard-based architecture PROLOG program that controls the interaction between the CCL agents and the communication agents, or knowledge sources. The CCL knowledge sources are the experts based on a number of knowledge-based systems. Typically, there are two types of CCL knowledge bases: One is pertinent to user information, and the other is knowledge about databases. The user knowledge base system stores information relevant to a particular user or a group of users. The database knowledge base contains information needed to translate CCL commands into host database

```
Loading DROLS knowledge base ...
---------

CCL > explain

The EXPLAIN command provides information on various topics in CCL DROLS. The following topics
can be explained:

choose  define  display  explain  find  show  start  stop

CCL > explain choose

The CHOOSE command identifies the database to be searched on DROLS. The format of the CHOOSE
command is:

   CHOOSE <database-id>

Three files are currently available on CCL DROLS. These are:

   Technical Reports File (TR)
   Work Units Information System (WU)
   Current Reports File (CF)

DROLS has no default database. CCL, however, has defined the Technical Reports (TR) File as the default
file if the CHOOSE command has not been invoked. If you would prefer to change that default to another
file more convenient to you, you may do so in the User Profile Knowledge Base.

CCL > choose  -etc.-
```

Figure 4. DGIS CCLS prototype: The "explain" for "choose" in DoD-DROLS; note reference to including a user-chosen default database in the User Profile Knowledge Base.

```
Loading DROLS knowledge base ...
---------------

CCL > show

The following topics are available for SHOWing:
     news time cost find choose display

CCL > show news

     Currently there four CCL prototype systems :

          BRS, DIALOG2, DROLS, and NASA

     The following commands are possible in these prototypes

          CHOOSE FIND DISPLAY

     and the support commands:

          EXPLAIN DEFINE DELETE SHOW START STOP

     Comments and feedbacks are solicitated and please send them to

          bixby@dgis and kuhn@dgis

CCL >  -etc.-
```

Figure 5. DGIS CCLS prototype: "show news" for DGIS CCLS.

commands and to understand the returning results and errors from the database. The control program is an object-oriented blackboard-based program in which the blackboard is nothing more than a general object that registers and monitors progress of the related knowledge sources (Tran, 1987).

The very basic problem of CCL surfaced as our experience grew. We learned that creating "Common Command Language" was *not* a panacea; programming a "standard" command language was in actuality only substituting one command language for another. The idiosyncracies of information systems include individualistic formats for displaying information, distinctive options for information selections, and a lack of functional information that an expert searcher knows but is not indicated on the system. The major effort involves establishing a CCL system that aids the searcher in searching unfamiliar information systems as well as the familiar ones. Our implementation of AI-based tools to do this will hopefully achieve this universality.

```
DGIS/vax[1]% ccl
-----------------
Loading NASA knowledge base ...
Loading User Profile Knowledge Base ...
-----------------
CCL > choose
NASA-RECON identifies its databases by number or by letter. Please consult system documentation for
proper database identification.
Illegal CCL command !!
CCL > choose a
You have chosen NASA-RECON file a
CCL > find
    select [ ]   <<<<This is the echo target database (NASA) entry
          SELECT
          TERM IN SELECT COMMAND NOT IN DICTIONARY
        ENTER:
CCL > find artificial intelligence
  select artificial intelligence   <<<<echo
        1  2718    2718 ST/ARTIFICIAL INTELLIGENCE
        ENTER:
CCL > display
Invalid CCL command.
CCL > explain display
The DISPLAY command initiates an online display of results from the immmediately preceding search
results set. Three DISPLAY commands are currently available on CCL NASA-RECON. These are: -etc.-
CCL > display short 1-3
The DISPLAY command in CCLS NASA requires specification of a set number. Please re-enter your
DISPLAY command in the format:
   DISPLAY <set no.> <format> <items>
CCL > display 1 short 1-3
 browse 1/6/1-3   <<<<echo
      BROWSE  1/6/1
   88A29425  ISSUE 11  PAGE 1738  CATEGORY 61  87/00/00  176 PAGES  In
   RUSSIAN  UNCLASSIFIED DOCUMENT     COPYRIGHT
UTTL: Pattern recognition and natural language understanding by a computer --
   Russian book
AUTH: A/FAIN, VITALII SAMOILOVICH
   -etc.-
-----------------
CCL > stop
Current system must be terminated before another system can be started.
CCL > stop
••• Goodbye •••
[ End of Prolog execution ]

••• GOODBYE •••

DGIS/vax[2]%
```

Figure 6. DGIS CCLS prototype: a sample CCL search and retrieval session, including mistaken entries with CCLS responses.

```
DGIS/vax[1]% ccl

     *** Welcome to DGIS CCL ***
----------

Please specify a CCL system (^D to exit) > brs

----------

Login Completed

Loading BRS knowledge base ...
Loading User Profile Knowledge Base ...
[/ai/ccl/proto/userkb/kuhn.pl consulted (0.300 sec 340 bytes)]
----------

CCL >  -CCL session-

CCL > stop
*** Goodbye ***


[ End of Prolog execution ]
*** GOODBYE ***
DGIS/vax[2]%
```

Figure 7. DGIS CCLS prototype: example display of opening and closing a CCLS session.

B. *Projected AI Applications*

The DGIS has two basic purposes. The first is its mission, which is to service the DoD community for accessing the plethora of information systems and giving the users capabilities to tailor that information to their needs. The second is to serve as a prototype environment for enhancing information access for the DoD community. We have identified a number of tasks as candidates for the application of AI technology. The main criterion for these efforts is the beneficial effect on and for the user. The primary goal is to implement programs that make the electronic system appear to have human-like responses. The tasks to achieve this include (Kuhn, 1987):

1. *Diverse Database Query Expert System:* The refinement of the query ("Is this what I am really asking?"), and transmission of the query to invoke the search relative to the database functionality. This system would include the following subsystems:

a. Query Analysis System—System for refining the user's search query, patterned after standard reference librarian query refinement models, in natural language.

b. Subject Searching System—Extension of the Query Analysis System, making use of multiple database thesauri.

c. Full Text Search System—Searching documents in their language implies the need for making use of the user's language, that is, natural language querying. Such a system needs to provide for retrieving user-designated size sections containing the user's topic in context, for browsing documents online, and capabilities for analyzing and processing text information.

d. Information Scan System—Scanning of user-selected sets of databases for query results, to determine the results volume and consequently the usefulness of each database in the set pertinent to the query.

e. Trending and Projecting System—Statistical-based trending, along the lines of management trending and projecting packages.

2. ***Thesauri Integration for Expert Searching:*** Development of a system to apply external database thesauri for determining relevant databases in response to a user's query.

3. ***Information Processor Systems:*** AI-based systems that would enhance and expand the quality of DGIS information postprocessing; would include:

- duplicate and irrelevance analysis system,
- relevance analysis system,
- analysis graphics,
- information product system.

4. ***Routine Generator Expert System:*** Creating generators for routine processes, for use by both programmers and users. This system would make use of bidirectional natural language to define the routine, state the requirements, and build the generator. Example generators are:

- Common Command Language Translator Generator,
- Connection Agent Generator,
- Standard Citation Format Translator Generator.

5. ***Foreign Human Language Interfaces:*** Incorporation of programs that would provide passive and interactive machine translation and transmission, such as:

- translation of foreign language information retrieved from foreign databases,
- translation into English of messages received on the electronic mail, with reciprocal translation from English,
- communicating interactively with foreign language databases, with inter-

active translation between English and the language of the database or record,

- interactive translated communication with foreign-language–speaking people while making use of the DGIS capability to "talk" interactively via the keyboard. An extension would be translation of voice-generated data.

6. *Numeric Information Query and Processing System:* A system for identifying numeric information sources, and aggregating, analyzing, and synthesizing that information.

7. *Information Analysis and Expert-System Application System:* A system that analyzes the information content of a targetted universe, clarifies the purpose of the intended Expert System, and recommends the standard categorical Expert System functionality.

Our goal in implementing AI-based programs to information retrieval is to allow DoD managers, engineers, and scientists to overcome the barriers of user–system communications. The incorporation of AI applications in DGIS, in making the human–machine interface more human-like, will incorporate tolerance of human frailties that are caused by the complexities of the human mind.

C. *AI in Hypermedia*

Bitmap systems are becoming popular and are proliferating throughout DoD. These systems encompass not only workstation-size systems but also desktop units, which are the "new" microcomputers. These systems, regardless of their physical size, have capabilities that now permit the integration of media, and therefore permit entry into hypermedia implementations.

As to DGIS entry into hypermedia, we have only started looking into AI-based aspects of hypermedia applications in a desktop environment for CCL. Figure 8 shows a composite representation of our initial entry into AI-Hypermedia. CCLS is being used as the vehicle, merging bitmap system capabilities and PROLOG-based CCL. We are currently exploring this application on a SUN 3-260 workstation, making use of icons, windowing, simultaneous session displays, and color. A hypermedia link to CD-ROM information bases is a near-term effort. We feel that getting into the hypermedia environment and looking at the multitude of possibilities will keep us ahead of what is already coming down the road: bitmap systems and hypermedia peripherals in the enduser environment. What we see taking place immediately are:

- icon drive—creating iconic systems to invoke DGIS operations,
- multiple window displays,
- simultaneous tasking—parallel and disparate tasks operating concurrently,
- the use of color—the medium is the message,
- multimedia accesses—online, CD-ROM, video disc, other storage media,

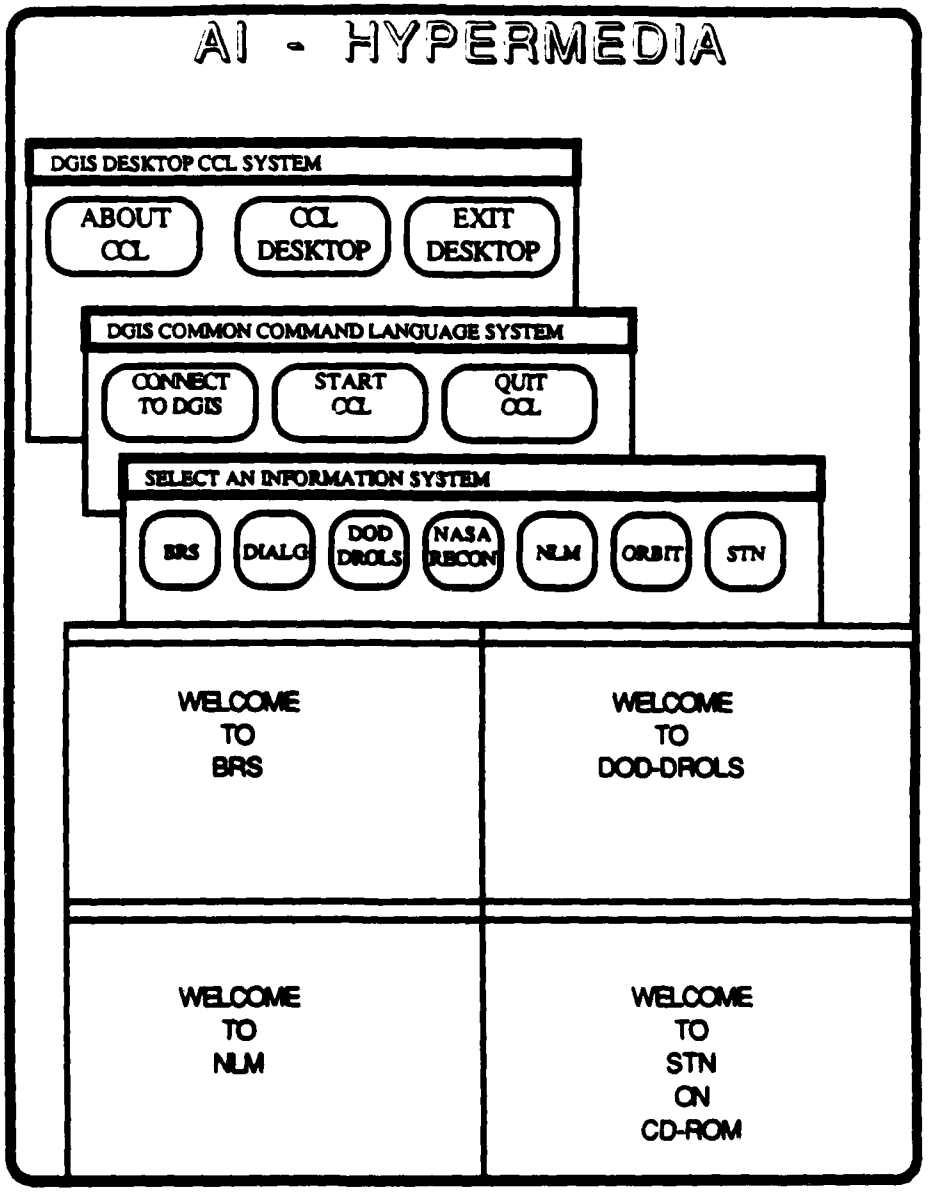


Figure 8. DGIS Entry into Hypermedia.

- intermedia accessing—simultaneous access of disparate media,
- simultaneous disparate window displays—text, static images, motion,
- sound—verbal/musical information supporting the visual information.

The goal in this case is to create an integrated hypermedia linkage that does not replace ASCII-based DGIS, but co-exists with DGIS as one of its power tools for the users who desire the capabilities.

RAMIFICATIONS FOR THE MICROCOMPUTER USER

The implementation of all the functions and processes of the DoD Gateway Information System demonstrates the feasibility of integrating diverse yet functionally compatible automation and information resources. It also demonstrates that a variety of technologies exist today—hardware, software, and telecommunications—that can be blended and modified to make the use of information retrieval systems easier and the results more meaningful.

Easy-to-use interfaces are exposing new users to the wealth of information available through information retrieval systems. As endusers learn to use the powers of systems, the perceived value of information will grow. As the amount of information continues to explode, so will the demand for information tailored to user needs. Gateway systems will evolve that present users with "views" of information personalized to meet their needs. Information "boutiques," organized by subject and interconnected, will form a virtual worldwide multimedia library.

But technology alone is not the answer. Advances in information retrieval depend on people—producers, vendors, intermediaries, endusers—working together and willing to modify and blend their skills in new ways. DGIS is purposefully designed to incorporate both endusers and their information management intermediaries in a complementary manner, making them resolute partners in the work and its rewards.

The microcomputer user alone can achieve only so much. DGIS puts the power of a centralized system into the hands of the microcomputer user, and the user combines the power of the micro with that of DGIS to cross the threshold into world information.

REFERENCES

Bixby, Randy L. (1987, October). *The DoD Gateway Information System (DGIS): Common Command Language Mapping* (AD-A185 951). Alexandria, VA: Defense Technical Information Center.

Cotter, Gladys A. (1985, October). *The DoD Gateway Information System* (AD-A161 701). Alexandria, VA: Defense Technical Information Center.

Cotter, Gladys A. (1987, September). Information retrieval systems evolve—Advances for easier and more successful use. In *Barriers to information transfer and approaches toward their reduction* (AGARD-CPP-430). Neuilly-sur-Seine (France): North Atlantic Treaty Organization (NATO), Advisory Group for Aerospace Research and Development (AGARD). Also available at The

Scientific and Technical Information Network (STINET): Foundation for evolution (AD-A189 750). Alexandria, VA: Defense Technical Information Center.

Gateway user support and training office. User's Guide to DGIS. (1987, May). Arlington, VA: BBN Labs. (1986, August).

Jacobson, Carol E., & Cotter, Gladys A. (1986, August). *The DoD Gateway Information System Directory of Resources* (AD-A174 154). Alexandria, VA: Defense Technical Information Center.

Jacobson, Carol E., & Jarus, Janice. (1988, February). *Directory of DoD-sponsored R&D databases* (AD-B116 400). Alexandria, VA: Defense Technical Information Center.

Kuhn, Allan D., & Cotter, Gladys A. (1986, September). The DoD *Gateway Information System (DGIS): User interface design* (AD-A174 150). Alexandria, VA: Defense Technical Information Center.

Kuhn, Allan D. (1987, May). *Toward an artificial intelligence environment for DTIC: Proposed tasks, recommended configurations, projected start-up costs* (AD-A181 103). Alexandria, VA: Defense Technical Information Center.

Kuhn, Allan D., Bixby, Randy L., & Tran, Duc T. (1987, August). *DoD Gateway Information System (DGIS) Common Command Language: The first prototyping and the decision for artificial intelligence* (AD-A185 950). Alexandria, VA: Defense Technical Information Center.

National Information Standards Organization (NISO) (1987, March). *American National Standard—For information sciences: Common command language for online interactive information retrieval* (DRAFT) (ANSI Z39.58-198X). Washington, DC: Author.

Tran, Duc T. (1987, October). *DoD Gateway Information System (DGIS) Common Command Language: PROLOG knowledge base profile* (AD-A186 150) Alexandria, VA: Defense Technical Information Center.

Microcomputers for Information Management

An International Journal for Library and Information Services

Volume 5, Number 2 June 1988

CONTENTS

Editorial

Ching-chih-Chen

As mentioned in the last issue, 1988's buzz word starts with "hyper"—hypertext, hypermedia, and hypercard. So, our year's first issue was devoted to heavier coverage on the topic. In this issue, we balance our contents to cover a diversified topical area.

Kuhn and Cotter provide the readers with an interesting account of a rather sophisticated gateway information system currently being developed by the Defense Technical Information Center of the US Department of Defense by utilizing a great variety of hardware, software, and communication technologies. This integration of diverse yet functionally compatible automation should be of great interest to our readers, as is its current development in artificial intelligence and hypermedia applications.

Day and Matheson highlight the development of a practical and useful microcomputer-based interlibrary loan system in a Canadian academic library. Their article illustrates the background, the process, and the issues and problems of such a development, which many of our readers can appreciate.

Kelly, Andre, and Morrison present interesting survey results on delivering agricultural information to patrons in alternative information formats—hardcopy, online or via digital videodisc. This is an important area in which additional research is needed.

Finally, in keeping up with our international interest, Greenfield examines the implications of technology transfer in the area of computer, communications, and information technology, from the first world to the Asian third world countries. Several profound questions are raised on the utilization of new information technologies to developing nations. They deserve our thoughtful consideration.

As usual, the MicroWatch column is full of newsy items. In line with the dynamic developments in the optical information areas, more items related to optical products, services, and systems are included for the readers' interest. Your comments and input are invaluable in helping me to shape the contents of this section, since there is so much going on!

Microcomputers for Information Management

An International Journal for Library and Information Services

Ching-chih Chen, Editor-in-Chief

ADVISORY BOARD

Kenneth E. Dowlin
Pikes Peak Library District
Colorado Springs, Colorado

Charles M. Goldstein
National Library of Medicine
Bethesda, Maryland

Audrey N. Grosch
University of Minnesota
Minneapolis, Minnesota

Carl Keren
Tel Aviv, Israel

Kari Marklund
Linköping University
and Lund University
Sweden

Robert M. Mason
Metrics Research Corp.
Atlanta, Georgia

Peter Noerr
Information Management &
Engineering, Ltd.
Kingston on Thames, England

W. David Penniman
AT&T Bell Laboratories
Murray Hill, New Jersey

David I. Raitt
2582 HL Den Haag
The Netherlands

Microcomputers for Information Management
is published quarterly by
Ablex Publishing Corporation, 355 Chestnut Street,
Norwood, New Jersey 07648.

Volume 5, 1988

Institutional Subscription: $72.00
Personal Subscription: $29.50

An additional charge of $11.00 will be made for overseas subscriptions.

Copyright © 1988 Ablex Publishing Corporation, 355 Chestnut Street, Norwood, New Jersey 07648. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, microfilming, recording, or otherwise, without permission of the publisher.

Printed in U.S.A.

ISSN 0742-2342