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User Procedures Standardization for Network Access

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User Procedures Standardization for Network Access

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FOREWORD

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1. Primary Issues in User Needs
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   T. N. Pyke, Jr.
   COMPCON, 1973
   Seventh Annual IEEE Computer Society International Conference

3. Computer Networking Technology - A State-of-the-Art Review
   R. P. Blanc and T. N. Pyke, Jr.
   COMPUTER Magazine
   Computer Society of the IEEE

4. Review of Network Management Problems and Issues
   A. J. Neumann
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   October, 1973

5. Annotated Bibliography of the Literature on Resource Sharing Computer Networks
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R. P. Blanc
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11. Network User Information Support
A. J. Neumann
NBS Technical Note
Fall, 1973

12. Quality Service Assurance Experiments
R. Stillman
NBS Technical Note
Fall, 1973

13. A Guide to Networking Terminology
A. J. Neumann
NBS Technical Note
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14. Research Considerations in Computer Networking
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USER PROCEDURES STANDARDIZATION FOR NETWORK ACCESS

A. J. Neumann

User access procedures to information systems have become of crucial importance with the advent of computer networks, which have opened new types of resources to a broad spectrum of users. This report surveys user access protocols of six representative systems. Functional access requirements are outlined, and implementation of access procedures is analyzed by means of a common methodology.

Qualitative assessment of standardization possibilities identifies standardization candidates such as: system and user signals, on-line user entries, system requests, and network wide categories of message content.

Key words: Network access procedures; networking; standardization; user protocols.

1. INTRODUCTION

User access procedures to information systems (user protocols) are concerned with all actions a network user has to perform to be able to use the facilities offered by the network. These access procedures have become of crucial importance, especially since computer access no longer is the exclusive province of the computer operator or programmer. It is now available to many users, to computer specialists as well as to members of other professional groups interested in research and routine operations.

Access to computers is enhanced by the development of networks. Remote users, with a relatively inexpensive terminal, can now have access to a variety of computer resources on a country-wide basis. As computer systems have proliferated, so have methods of access. The present state of the art is one of great diversity, so much so that the large variety of access methods often makes it difficult for the user who is looking for simple, uniform, and reliable access methods, yet wants to use diverse resources. Ideally, therefore, access should be similar to that used for world-wide telephone networks, where simple, uniform dialing devices, procedures, and numbering schemes facilitate operation.

This study is concerned with a description of access (and exit) mechanisms, as the user sees them. Some conclusions will be then offered as to possible directions for standardization, which may help to unify procedures, and aid the user in access to these systems. The immediate task of this report is to collect data on access mechanisms with a view to providing a basis for further work in planning, developing guidelines, and possible standardization efforts.

2. FUNCTIONAL SUMMARY

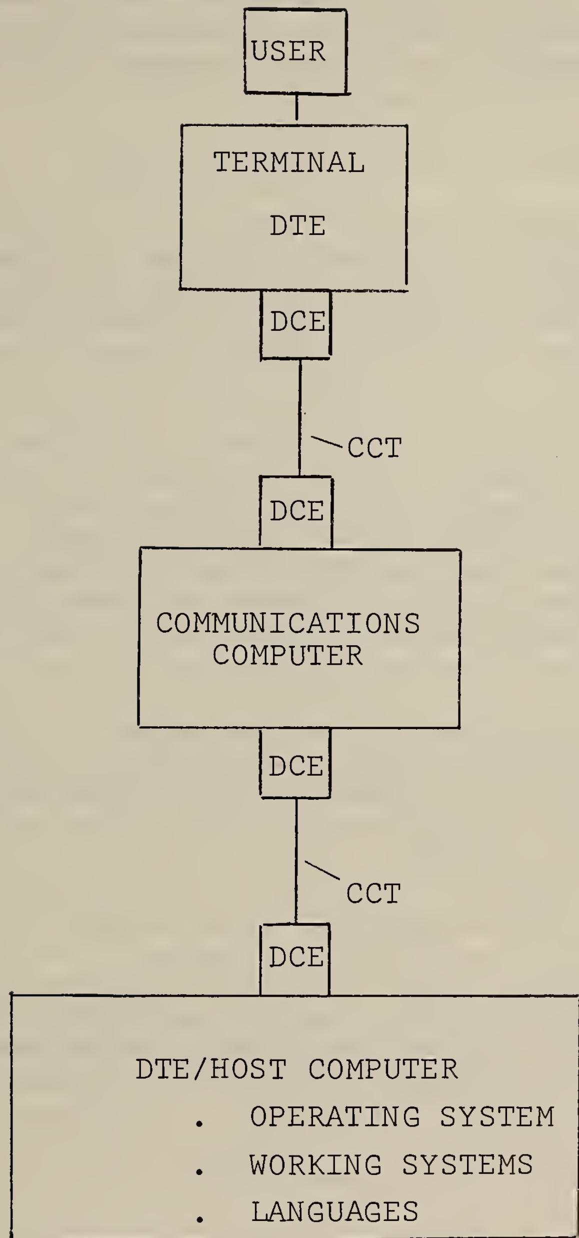
An access procedure, as seen by the user, consists of a series of data entries into the system and of observation of data outputs from the system, or reactions by the system. These actions follow each other in a predetermined manner and continue until the access procedure is completed.

The point of contact for the user is a terminal which provides keyboard entry and display capability. Display may be in the form of hard copy, or it may be volatile, such as on a cathode ray screen. There are several distinct phases of access which depend on both the characteristics of communications and computer hardware, and on the requirements for access control, handling of traffic, accounting and billing, or control of proprietary information. Figure 1 illustrates a functional breakdown of subsystems. It shows user data terminal equipment, communications equipment, communications circuits, and a host computer providing an operating system, user languages and application packages. The communications channel may include computers, such as communications computers and interface message processors. Terminal equipment in addition to an operator terminal may provide computing capability.

The various phases of access are: initialization, establishment of a data transfer channel between communications equipments, establishment of a data link from terminal to the host computer, which results in computer access and the operation of the working program. Included also must be procedures required for reversal of the process, including program exit and shutdown of the source data terminal equipment.

2.1 Initialization of User Access

The process of accessing a computer network starts with the preparation of communications equipment by the operator. Power for the terminal proper and ancillary



CCT = Communications Circuit
DCE = Data Communications Equipment
DTE = Data Terminal Equipment

NETWORK ACCESS SUBSYSTEMS

Fig. 1

devices, among them acoustic couplers, are turned on. Where a choice of terminal speeds is available, the proper speed is selected. Similarly, a communications mode (half duplex, full duplex) and other terminal options must be selected and, in turn, activated.

2.2 Establishing a Communications Channel

Next, a communications circuit is established between the user's terminal equipment and the equipment at the host computer. This mav be done by message switching or circuit switching systems. User access is usually through a dial-up connection but dedicated access channels are also available.

In some networks, this process requires several steps: first, a local communications computer is dialed, and later a remote computer address is entered. This selects and connects with the desired host computer. Establishing the communications channel involves the recognition of the terminal characteristics in terms of terminal speed, character set, and communications mode. Though there are some systems that provide automatic terminal recognition, in many cases the user assists in the process by transmitting a terminal identification code. A few communications computers perform user identification and access control, but this is normally done by the host computer.

2.3 User Identification

User identification, for both accounting and access control purposes, requires the operator to enter some special information. Usually, such entries involve a user number, password, project number, personal identification code, or similar information. Most of this information is entered by keyboard action in a character-by-character mode.

2.4 Authorization and Access

Based on the information supplied by the user, the system validates his access request, and authorizes access to the system. In cases where invalid passwords and/or user numbers are detected, user access is terminated.

2.5 Obtaining Status Information

At some time during the access sequence, the user is informed of the network status. He may be told of the present configuration, the latest software version in use, the port number, concentrator and remote concentrator numbers. He is also informed of planned shutdowns or intended system changes. In addition the operability of the system is often indicated by a "greeting message," including date, time, and other accounting details.

2.6 Computer and System Selection

A common task of interest to the user is the selection of the computer site, if he has a choice of more than one. Further decisions must be made regarding desired computational or information processing programs and processes. For these purposes, the user enters a site address and various codes referring to the systems to be accessed.

2.7 Completion of Login

After the access sequence is completed, the system sends a "system signal" to the user. This means that it is ready for use. At this point, the user may access the working system of his choice and begin operations.

2.8 Logout

The reverse procedure takes place upon leaving a system. After the user indicates his desire to end operations, the system responds by transmitting data about terminal time used, computer time used, and date and time of logoff. Finally, an "end message" informs the user that he has been duly logged out and that the system is disconnecting.

Usually the user must inform a hierarchy of systems of his desire to terminate a session. These may include the working system, the host operating system, and the communications computer. There are, however, instances where this sequence has been simplified so as to permit logout by only one user command.

2.9 Accounting Data

At the end of the terminal session, the user receives usage measurements. They include time measurements and amounts of storage which record used resources. As a rule this is part of the logoff procedure. These measurements are reported together with the appropriate user and account number, to assist him in managing his own resources and results.

3. MESSAGE TYPES AND PROCEDURES

The access procedure thus consists of an exchange of actions and reactions between the user and the terminal, which represents the total system to the user. Messages exchanged during the access protocol may be of an informational type or of a command type. Commands from the user to the system are called system commands, or user commands. Messages from the system to the user are called system requests, or system messages. Figure 2 summarizes the various message types.

3.1 Informational Messages

Informational messages convey required data to the user, or to the system for purposes of accounting, usage-measurement, or system performance measurement. Typical messages of this nature deal with time, date, location, system status, expended resources and system characteristics.

3.2 Command Messages

Command messages, on the other hand, require immediate action, either on the part of the system, or on the part of the user. Typical action commands are system requests like: "LOGIN PLEASE," or "USER NAME" or commands to the system such as "OFF" or "QUIT," which are used by the user to terminate operations. Identification data also fall into this category.

3.3 Special Command Signals

Two kinds of signals merit special mention: the "user signal" and the "system signal" named by Little and Mooers (1).[1] The user signal is entered by the terminal user to denote that his immediate task of data entry is finished and that he is waiting for system action. Likewise, the system signal, which is produced by the computer, tells the user that processing is completed and that the next step is up to him. In interactive processing, these signals are used most frequently, and thus play a special role.

3.4 Message Sequencing

Diversity of system access procedures exists in the variety of data elements contained in the informational and command messages. In addition, sequencing of the

[1] Figures in parentheses indicate the references at the end of this paper.

	INFORMATION MESSAGES	COMMAND MESSAGES	
USER TO SYSTEM	USER MESSAGE (UM) . informational text to system	SYSTEM OR USER COMMAND (UC) . directive to system to do a job . response to system request . procedurally required	USER SIGNAL (US) . message or task finished! Proceed!
SYSTEM TO USER	SYSTEM MESSAGE (SM) . informational text to user	SYSTEM REQUEST (SR) . request for user action, requires response	SYSTEM SIGNAL (SS) . message or task finished! Proceed!

MESSAGE TYPES

Fig. 2

various elements involved in the access, i.e., the access sequence syntax, must be considered. The latter contains both system messages and user messages.

3.5 Degree of Interactivity

Depending on their objectives and skills, users' needs differ as to their degree of freedom in system access. A novice user appreciates detailed step-by-step prompting from the terminal. It is equally important to him that he be able to put in his reply on a simple step-by-step basis, while the experienced user may be willing to trade time and complexity, requiring a minimum of guidance from the terminal. For these reasons, most systems provide several access alternatives at the user's option.

4. COMPARISON OF SYSTEMS

Access procedures for a few representative systems have been analyzed and results are reported here. Included in this analysis were two commercial time sharing systems, three data base oriented information retrieval systems, and one node of the ARPANET. The systems were: BASIS (A), GE MK II (B), INFONET (C), MEDLINE (D), NIC/ARPANET (E), and SPIRES (F). The ordering is alphabetical, and letter codes in parentheses are used to refer system features to the particular systems, and to the protocol analyses on pages 19, 21, 23, 25, 27, and 29.

The analyses were limited to development of a uniform methodology of description of data elements, element sequencing, and of categorization into message classes.

User and system generated messages are considered. Not considered were data element format details. Data were collected by entering and leaving the systems under test, and by printing out the access protocols on a teletypewriter. These printouts are shown in Figures 4, 6, 8, 10, 12, 14, and 15.

Each protocol was then analyzed as to message type and sequencing. These analyses, in a uniform format, are shown in Figures 3, 5, 7, 9, 11, and 13.

The following conventions have been observed in documenting the access sequences for the various systems. A serial number denotes the position of each data element in the access sequence. The sequence is characterized by four types of messages: system message (SM), system request (SR), user message (UM), and user command (UC). The system signal is denoted by (SS), while the user signal is denoted by (US). Message categories are denoted by capital letters. Marginal comments are in standard upper and lower case. End of the login sequence is shown by a series of dashes. Several message elements printed on the same line have their own sequence numbers. The logout sequence starts after an appropriate systems signal.

Comparison of user command and system message data element categories and data element sequencing are shown in Figures 16, 17, and 18. Numbers in the boxes of the tables refer to the individual analyses, and indicate the ordering of the elements.

Results were not correlated with pertinent systems documentation, nor have all possible variants of display formats and message sequencing options been explored. The examples cited are however representative and serve the purposes at hand. Discussion of access sequence details follows in the next sections.

4.1 Initialization

In this experiment, a typewriter-like terminal with hard copy output was used. It was connected to the Bell Telephone System through an acoustic coupler. Initialization here involved turning both coupler and terminal power to "on," and setting of the coupler mode to either "duplex" or "half-duplex." Other terminals may have different and additional initialization requirements.

4.2 Establishment of Data Channel

Access to systems was through the Bell System. In some cases access is via long distance connections (A), while in the case of ARPANET a local communications computer (Terminal Interface Processor, TIP) provides network access as well as common carrier switching control for remote computer access (E). Various means are used to indicate to the user that communications have been established. A system request "PLEASE TYPE THE LETTER D" (D), a system message giving configuration code, time and time zone, and date, or no reaction at all, are typical cases. In the latter case operating procedure requires that the user enter a terminal recognition code, which elicits the first system response (E). If, as in the ARPANET, more than one computer is involved, a hierarchy of communications protocols is required, i.e. user to TIP, TIP to host and finally user to host. After receipt of the systems message from the TIP, and selection of the host address, a system message indicating communications status confirms completion of the data link (E).

4.3 Initial System Messages

A variety of system messages indicate that the data link has been completed, and that terminal to computer connection has been established. Such messages range from a mere "HELLO" (E), to more complex messages giving terminal identification codes, date and time messages (C), as well as messages indicating location, date and time (F). Other initial system messages give system and communications status (E), and identification of systems software (E) (A), equipment and port designations (C).

4.4 User Signal

User signals vary from system to system. On the ARPANET several different user signals are being used to enter a remote host. Entering of the host address, identification sequence, and working system code require depression of one terminal key, the "line feed" character. Working program exit requires actuation of two keys, "control," and "D." Other user signals are "carriage return," "new line," and "control, S" (F).

4.5 System Signals

Completion of a system action is indicated most often by a "carriage return" following a "line feed." In addition often a "prompt" signal indicates that the system is ready for user entry. A variety of symbols are used for this purpose such as: the "at" character "@" (E), exclamation mark "!" (C), and question mark "?" (F). Other systems use words like: "COMMAND" (A), "USER" (D), or "READY" (B).

4.6 Identification

An identification request is sometimes implied by system requests like "PLEASE LOGIN" (A) or "LOGON" (C). In other cases identification is required by standard operating procedure, where the user, upon receiving the initial message and a prompt signal, enters his identification data, like user number, password and identification code (E). Some systems request identification detail explicitly with system requests like "PASSWORD," or "USER

NUMBER" (B) (C). Password protection is obtained by non-printing (E) (D), or by underprinting (A) (B). Other detail required are organization codes or account numbers, and personal identification codes (E).

4.7 Authorization and Access

Invalid passwords or user numbers, like format errors in entry of identification data may lead to repeated system requests for login, or result in the disconnection of the system. Figure 15 shows several user numbers which were unacceptable to the system because of format error, and brought about the subsequent disconnection of the system.

4.8 Resource Selection

In the ARPANET, indications of the host address code "L 2," initiates the establishment of a connection between the user and the remote host (E). After receipt of the greeting sequence and of completion of LOGIN, the selected program is indicated by inserting the proper code.

In the GE MK II system, the system long form version may request the programming language and the file to be used. In the sequence shown here, the user selects files and languages after being put into the READY condition (B).

4.9 Logon Statistics

Some systems provide a "logon date" except (D) and (B). They also indicate logon or contact time. One system provides both: contact time for the first system contact and logon time for the actual system access (A).

4.10 Logoff Statistics

All logoff statistics provide time and resource usage information in all cases except one (D). That system apparently is of an experimental nature, and metered user charges are not used. (B) includes the time zone.

The ARPANET furnishes additional information, including a job number, user number, account number, as well as a terminal number (E). Other systems account for System Resource Units "SRU" used (C) or for Computing Resource Units used "CRU" (B).

4.11 End Message

Two of the tested systems conclude with a final system message: "GOOD BYE" (C) and "END OF SESSION" (F).

4.12 Sequencing and Format Options

Most systems provide several format options. Sequence formats vary from a completely "interactive mode," where each data element is entered separately and evokes a system request for the next data element, to a "terse sequence," where all data elements are entered sequentially, separated only by the proper syntax separator (space or comma). In the interactive mode there are variations among the systems. The system response may be a system signal, or it may also be an explicit request for the next data element, as illustrated by one commercial system which calls for user number and password as the initial logon step. In that system, this information may be entered as:

(user number)(comma)(password)(user signal)

and will elicit a request for "project identification." A permissible variant in that procedure is to follow the sequence of:

(user number)(comma)(user signal)

This will automatically provide an explicit request for the password. When given, the password is then automatically obliterated by a dense character field, thus shielding it from human view, yet permitting machine recognition. An example of an interactive, prompting sequence is shown in Figure 12.

4.13 Default Procedures

User errors in entering logon data elements are generally handled in different ways. In the extreme case, an error might disconnect the system and require reestablishment of communications and of the login process. On the other end, user errors would be interpreted by the system and corrective system messages would provide guidance. The systems examined here operate somewhere between these extremes.

Common user errors occur through the omission of space characters where required, through the use of wrong separators (comma instead of space character), or through the entry of the wrong sequence of data elements. Usually the systems react by printing repeated requests for logon and then by system cutoff, after a specified number of attempts to enter the system have been made. Figure 15 shows reaction of one system to erroneous data entry. After two attempts of entering a wrong user number with syntax errors (omission of space character, and substitution of zero character for the alphabetic character O) and two requests for LOGON the system disconnected.

The preceding discussion illustrates the variety of message elements and procedure which make up the user access sequences for the various systems. Indications are that technical changes will continue, although functional requirements appear to be relatively stable. Possible standardization efforts must take the functional needs and the rapidly changing technology into account.

5. STANDARDIZATION OF USER PROCEDURES

Standardization of user procedures presents many problems. For this reason, there must be a compromise between ideal requirements and the capabilities of those concerned with implementing them. This is particularly true when time, personnel, and financial resources are limited. Requirements are based on the user's needs, while implementation of requirements needs to follow a course that will produce the most desirable features with limited resources.

There also is the question who should develop the standards, private industry or government, and the question of how badly a particular standard needs to be developed. Early standardization in a developing technology may inhibit progress, while lack of standardization may lead to a proliferation of non-compatible features. In the case of network access procedures, this may impact adversely on ease of computer access and use. Standardization efforts must also be concerned with the costs which might be incurred by the systems, which may want to adopt proposed standards.

5.1 Need for Standardization

The need for standardization in network access procedures has been recognized by users of timesharing systems for some time, especially by those who use different systems alternately. The need is now being accentuated with the advent of networking capabilities, where data requirements are increasing for identification, authorization, accounting, and data protection. At the same time, network communications computers, more than ever before, must recognize a great variety of terminals and terminal options, and both terminal facilities and host computers must interact with communications protocols of greater complexity to an ever increasing extent.

5.2 Standardization Criteria

Since the standardization process is slow and time consuming, standardization objectives must be carefully determined. These are some criteria, on the basis of which goals may be established: (1) frequency of usage of item to be standardized; (2) commonality, and (3) required precision.

Data elements, or message representations frequently used by many users would, if standardized, provide ease of use and reduction of user errors. They would also enhance the operation of the system. Therefore, system messages to users from different systems having the same meaning should also have identical representations. As an example, the use of a question mark, asterisk, dash, or other graphic symbol as a system signal adds to user confusion and dissatisfaction, when meanings in the various systems differ. Further, in cases where precise user input for machine recognition is required, format standards would improve system operations. On the other hand, system messages of an informational nature, not requiring immediate user action, may be in free format, and their design is governed by the basic rules of grammar and by readability considerations.

Common use of symbols requires uniformity, not only for machine-readable data but for concepts and human readable information as well. Categories of access, accounting classifications, and types of malfunctions, for instance, need to be described and categorized clearly and uniformly if inter-system operation between various services is expected in the network environment.

5.3 Standardization Possibilities

Opportunities for standardization of access procedures exist in the areas of: message content categories, types of messages, message formats and sequencing, and descriptive terminology.

5.3.1 Message Content Categories. Standardization of message content is desirable as it relates to classification schemes which are descriptive of message content, such as data descriptions, file descriptions or program descriptions. Likewise network statistics and measurements depend on the classification of system characteristics of equipment and of software, just as accounting procedures depend on the structure of accounts.

5.3.2 Types of Messages. The first candidates for standardization of message types would be the user and the system signals. Their meanings are unambiguous and precise, they are the ones most frequently used on all systems. Uniformity in the meaning and use of these signals would help the use of multiple systems. Next in line would be "on line user entries," i.e., user commands (system commands) requiring precise machine interpretation and reaction. Similarly, system requests addressed to the user require precise reaction by the user and could be standardized. Also, the standardization of user entered informational messages is of importance from an overall systems standpoint. Though they do not affect control operations, uniformity in inter-systems accounting, access procedures, and statistical data collection is required. Similarly system messages, in coded form require standard definitions to be universally understandable.

Some beginning has been made in standardization of control elements. Little and Mooers (1) have defined twelve universal user control actions, and have suggested the assignment of standard symbols to these actions. Additional actions will be required for network operations. Standardization at this functional level appears practical and desirable. There is an interaction with existing information exchange codes (ASCII Code) (3) which also provide for control characters. They do not cover all needed functions, but standardization of additional functions is in progress. Terminal access standards development needs to be closely coordinated with this work.

Standardization of informational data elements is a more difficult matter. Some beginning in this area has been made, and continuation and coordination is required. A standard for date representation has been developed (8) and acceptance of a standard similar to the date-time group in military communications can be envisioned. Other standard designations might be developed for resource center locations (along the lines of the three character airport codes) for computer system configurations, and for software designations. Uniformity of definitions would permit meaningful exchange of operating statistics and correlation of system performance parameters. Other data elements that might be candidates for standardization are those pertaining to system characteristics and error taxonomies.

5.3.3 Format Standardization. Format standardization may occur at several levels. On a higher level, an entry procedure consists of a series of interconnected messages. Their sequencing may be arranged in different ways according to ease of use from the users' viewpoint, or according to the ease of processing from the systems' viewpoint. On the level of individual messages, or words, format considerations arise and need consideration.

5.3.3.1 Message Sequencing. Figures 16, 17, and 18 show that, although there is some agreement among data elements entered into and received from the systems, there is little uniformity in the sequencing of data elements within the access procedures. Just as in international telephone dialing, where a country code is selected first, followed by an area code and some local digits -- which represents a hierarchy of switching facilities -- a general conceptual ordering of access information appears feasible. No recommendation or suggestions on how to achieve this can as yet be made, but the topic of sequencing merits further consideration, from the standpoint of both the user and the system whose software must process these messages.

5.3.3.2 Word Formats. Then there is the issue of word formats which directly relate to the ability of a system to recognize and respond to its inputs. Such details as punctuation marks and space characters which may appear trivial to the user, often have syntactic meaning to control software. Though of no interest to the human reader, their use must be precisely specified.

Little and Moers have taken a dim view of format standardization, stating that "since data formats have a potentially infinite variety, it is futile to consider the standardization of formats themselves." (1). They propose instead the standardization of data descriptions, the logical development of elements of format generation, and finally a standard method of describing external data formats for entry and display. Nevertheless, it is believed that some format-related standards might conceivably be developed and would find general acceptance.

5.3.4 Descriptive Terminology. Related to standardization of message types, content, and formats, is the descriptive terminology which is a necessary adjunct to standardization. Terminology needs to be unified, especially since technical considerations of network entry procedures involve such varied fields as data processing, telecommunciations, linguistics, computer sciences, and other engineering and human oriented disciplines.

6. CONCLUSIONS

User network access protocols are becoming of increasing importance in utilization of emerging computer networks. Standardization is required in some critical areas and will have beneficial aspects, in terms of user productivity and economics of network operations and utilization.

Standardization has been effected for keyboards (6), (7), but extension towards new requirements for user control of networks need to be added (2). Standards exist for data elements, such as calendar date (8), and states and counties of the United States (9), (10). Again there is further need for networking oriented effort.

Work is also underway to develop a unified language for describing technical concepts, hardware and software functions, and overall systems performance (4) (5). While this work is in progress, it needs the support of all those engaged in developing systems standards for network access. Additional definitions are needed in the specific area of access protocols and these definitions need to be integrated into network procedure standards efforts. It is essential that a common language be developed not only to simplify user operations but in support of training, maintenance, and the interchangeable use of common network resources.

In summary, it is concluded that there is need for standardization, that there are definable tasks to be undertaken, and that a standardization effort in user access protocols would well be worthwhile.

Such an effort must however be quite broad, consider existing and planned industry activities, economic impact on user and manufacturers, transitional problems, and relationships to existing and planned standards in related areas.

1,2	SM	"BATTELLE INTERCOM 4.0"	System, Version No.
3	SM	DATE	
4	SM	TIME	
5	SR	"PLEASE LOGIN"	
6	UC	"LOGIN"	
7	SR	"ENTER USER NAME"	
8	UC	USER NAME	
9	SM	"XXXXXXX"	Underprint
10	SR	"ENTER PASSWORD"	
11	UC	PASSWORD	
12	SM	SPACE	
13	SM	DATE	
14	SM	LOGIN TIME	
15, 16	SM	EQUIPMENT NUMBER/PORT NUMBER	
17	SS	"COMMAND"	

18	UC	"LOGOUT"	
19	SM	COMPUTE TIME	
20	SM	PP TIME	
21	SM	CONNECT TIME	
22, 23	SM	DATE, LOGOFF TIME	

BASIS PROTOCOL ANALYSIS (SYSTEM A)

Fig. 3

```
BATTELLE INTERCOM 4.0
DATE  05/15/73
TIME  15.39.15.

PLEASE LOGIN
LOGIN
ENTER USER NAME- STANBS013
[redacted] ENTER PASSWORD-





 05/15/73    LOGGED IN AT  15.40.18.
             WITH USER-ID RD
             EQUIP/PORT 77/50
COMMAND- BASIS

          B A S I S   7 0


DO YOU DESIRE OPERATING INSTRUCTIONS\
TYPE YES OR NO/NO
PLEASE ENTER YOUR LAST NAME. /NEUMANN
ENTER THE NAME OF DATA BASE TO BE SEARCHED.
/      NTIS
ENTER YOUR SEARCH ONE TERM AT A TIME.
 1/    QUIT
    B A S I S   7 0   HAS
ENJOYED SERVING YOU.
DO YOU HAVE ANY COMMENTS\
YES-NO/NO
(DONT FORGET TO #LOGOUT.# BEFORE DISCONNECTING.)
GOODBYE.............

END    BASIS
COMMAND- LOGOUT
CP TIME        .208
PP TIME       5.692
CONNECT TIME     0 HRS.  2 MIN.
05/15/73  LOGGED OUT AT 15.42.08.<
```

BASIS PROTOCOL (SYSTEM A)

Fig. 4

1	UC	TERMINAL RECOGNITION CODE
2	SR	USER NUMBER REQUEST
3, 4	UC	"USER NUMBER," "PASSWORD"
5	SS	"READY"

6	UC	"BYE"
7-9	SM	COMPUTING RESOURCE UNITS, TERM. CONNECT TIME THOUSANDS OF CHARACTERS STORED
10-12	SM	LOGOFF TIME, TIME ZONE, DATE

GE MK II PROTOCOL ANALYSIS (SYSTEM B)

Fig. 5

```
H
U#=aek73105,
READY


bye
0000.03   CRU     0000.01   TCH     0000.03   KC

OFF AT 15:30EDT 08/21/73
```

GE MK II PROTOCOL (SYSTEM B)

Fig. 6

1	SM	"T"	Communications Acknowledgement
2	SM	SPACE	Format Feature
3	SM	PORT NUMBER	
4	SM	CENTER ID	
5	SM	SPACE	Format Feature
6	SM	TERMINAL ID	
7	SM	DATE	
8	SM	TIME	
9	SR	"LOGON?"	
10	UC	SYSTEM CODE	
11	SR	"USER ID"	
12	UC	USER NUMBER	
13	SR	"PASSWORD"	
14	UC	PASSWORD	
15	SR	"PROJECT CODE"	
16	UC	PROJECT CODE	
17, 18	SM	UPDATE NOTICE ANNOUNCEMENT, DATE	
19	SS	"!"	

20	UC	"OFF"	
21, 22	SM	USAGE ON DATE AND TIME	
23, 24	SM	SRU / ELAPSED TIME	
25	SM	"GOOD BYE."	

INFONET PROTOCOL ANALYSIS (SYSTEM C)

Fig. 7

```
T

PORT: 64
CENTER: BB



TERMINAL 1071     05/15/73     13:00:43
LOGON:   GPS
USER-ID:   UBS002
PASSWORD:
PROJ CODE:   6400901
ADM999 I EDIT/L INFORM 5/14/73
!OFF
USAGE ON 05/15/73 AT 13:02:10
SRU'S:.8         ELAPSED TIME: 00:00:19
GOOD BYE.
```

INFONET PROTOCOL (SYSTEM C)

Fig. 8

1	SR	"PLEASE TYPE THE LETTER D"
2	UC	"D"
3	SR	"PLEASE LOG IN:"
4	UC	USER CODE
5	SR	"PASSWORD:"
6, 7	UC	PASSWORD (non printing), ACCOUNT NUMBER
8	SM	INTRODUCTION
9	SM	REQUEST FOR FORMAT OPTION
10	SS	"USER:"

11	UC	DISCONNECT COMMUNICATIONS

MEDLINE PROTOCOL ANALYSIS (SYSTEM D)

Fig. 9

```
PLEASE TYPE THE LETTER D

PLEASE LOG IN:   NLM

PASSWORD:   ;MEDNBSØL

PLEASE LOG IN:   NLM

PASSWORD:   ;MEDNBSØ1

THIS TERMINAL IS CONNECTED TO THE MEDLINE RETRIEVAL FILE SET

HELLO FROM NLM/MEDLINE. THE MEDLINE AND SDILINE DATA BASES NOW
CONTAIN JUNE 1973 DATA.  DO YOU WISH THE NEW-USER OR EXPERIENCED-USER
FORMAT?  TYPE N OR E AND STRIKE THE CARRIAGE RETURN KEY.

USER:
```

MEDLINE PROTOCOL (SYSTEM D)

Fig. 10

1	SM	"HELLO 306"	
2	UC	"@L 2"	Logon command, Host address no. 2
3, 4	SM	"LOGGER R OPEN T OPEN"	
5	SM	SYSTEM ID	
6	SM	FACILITY ID	
7	SM	OPERATING SYSTEM ID	
8	SS	"@"	
9, 10	UC	USER NO/ACCOUNT NO	
11	SR	"IDENT = "	Identification request
12	UC	IDENTIFICATION CODE	
13-16	SM	JOB NO/ TT NO/ DATE/ TIME	
17	SM	STATUS MESSAGE	
18	SS	"@"	
19	UC	ENTER	
20	SS	"*"	

21	UC	"E L"	Execute Logout
22-27	SM	JOB NO/USER NO/ACCT NO/TT NO/DATE/TIME	
28, 29	SM	COMPUTE TIME / CONNECT TIME	
30	SS	"@"	
31	UC	"C"	
32, 33	SM	"T CLOSED R CLOSED"	

NIC/ARPANET PROTOCOL ANALYSIS (SYSTEM E)

Fig. 11

```
HELLO 306
@L 2

LOGGER

 R OPEN T OPEN

 TENEX 1.31.20, ARC/NIC EXEC 1.50
@ NBS-TIP  3
 IDENT= AJN
             JOB 12 ON TTY46 12-JUN-73 13:38
 TENEX WILL GO DOWN WED 6-13-73 2200 TIL THU 6-14-73 0300
@NLS

PC DOES NOT EXIST
*EXECUTE QUIT
@LOGOUT
TERMINATED JOB 12, USER NBS-TIP, ACCT 3, TTY 46, AT  6/12/73 1339
  USED 0:0:5 IN 0:1:28
@C

 T CLOSED R CLOSED
```

NIC/ARPANET PROTOCOL (SYSTEM E)

Fig. 12

1, 2, 3	SM	STATION ID, DATE, TIME
4	SR	"NAME ?"
5	UM	NAME
6	SR	"ACCOUNT?"
7	UC	ACCOUNT NUMBER
8	SR	"KEYWORD?"
9	UC	KEYWORD
10	SR	"TERMINAL?"
11	UC	TERMINAL CODE
12	SR	"COMMAND"
13	UC	SYSTEM NAME
14	SM	WELCOME ETC, NAME
15	SS	"-?"

16	UC	"LOGOFF"
17	SM	COMPUTE TIME
18	SM	EDITING TIME
19	SM	ELAPSED TIME
20	SM	"END OF SESSION"

SPIRES PROTOCOL ANALYSIS (SYSTEM F)

Fig. 13

```
STANFORD  75  05/09/73 11:01:39

NAME? NEUMANN

ACCOUNT? I067

KEYWORD?

TERMINAL? W99

COMMAND ? SPIRES

-WELCOME TO SPIRES-2, NEUMANN

-?




-? LOGOFF

COMPUTE TIME = 3.39 SECONDS

EDITING TIME = 0.05 SECONDS

ELAPSED TIME = 00:16:47

END OF SESSION
```

SPIRES PROTOCOL (SYSTEM F)

Fig. 14

```
T

PORT: 64
CENTER: BB



TERMINAL 1233     05/15/73     13:04:55
LOGON:   UBS002
LOGON:   GPS
USER-ID:   UBS 002
USER-ID:   UBS002
GOOD-BYE
GOOD BYE.
PW
```

LOGIN SEQUENCE ERRORS (INFONET)

Fig. 15

	BASIS A	GE MK II B	INFONET C	MEDLINE D	NIC/ARPA E	SPIRES F
User Identification						
User Name	8					
User Number		3	12	4	9	
User Individual Name					12	5
Password	11	4	14	6		9
Account number/Org. Code			16	7	10	7
Terminal Identification				2		
Service Identification						
Host Address					2	
Data Base Code						
Working System			10		aft 20	13
File Type						
Language						
User Signal	CR	CR	CR	CR	LF	CS
LOGIN	"LOGIN" 6	Implied	System Code	User Code	Host Code	Name
LOGOUT	"LOGOUT" 18	"BYE" 6	"OFF"		"E L"	"LOGOFF"

Note: CR = Carriage Return
LF = Line Feed
CS = Control Key and "S"

USER COMMAND DATA ELEMENTS

Fig. 16

	BASIS A	GE MKII B	INFONET C	MEDLINE D	NIC/ ARPA E	SPIRES F
Introduction	1-5		1-8	8	1	1-3
System Details						
Configuration	15, 16					
Status						
ID	1, 2		4		5	1
Comm ID						
Comm Status					3, 4	
OS	2				7	
Equipment No.	15					
Port No.	16		3			
Terminal No.			6		11	
Station ID	1		4		6	
System Signal	"Command"	"Ready"	"!"	"User:"	"@","*"	"-?"
End Message	22, 23	10-12	25	---	32, 33	20

SYSTEM MESSAGES DATA ELEMENTS (I)

Fig. 17

Accounting Data			BASIS A	GE MK II B	INFONET C	MEDLINE D	NIC/ARPA E	SPIRES F
LOGON	date		3, 13		7, 18		15	2
	time		4, 14		8		16	3
	job no./acct. no.						13	
	TT no.				6		14	
LOGOFF	job no.						22	
	user no.						23	
	account no.						24	
	TT no.						25	
	date		22	12	21		26	
	time	compute	19				28	17
		elapsed			24			19
		connect	21	8			29	
		logoff	23	10, 11	22		27	
		editing						18
		PP time	20					
	SRU			CRU 7	SRU 23			
	Storage Units			9				

SYSTEM MESSAGES DATA ELEMENTS (II)

Fig. 18

7. REFERENCES

(1) "Standards for User Procedures and Data Formats in Automated Information Systems and Networks." Little, J. L., and Mooers, C. N., National Bureau of Standards. Proceedings of the Spring Joint Computer Conference, 1968, pp. 89-94, 4 references.

(2) "Functional Specifications for Typewriter-Like Time-Sharing Terminals." Dolotta, T. A., Princeton University, Princeton, New Jersey. Computing Surveys, Vol. 2, No. 1, March 1970, pp. 5-31, 25 references.

(3) USA Standard Code for Information Interchange, X-3.4-1968. United States of America Standards Institute. (Federal Information Processing Standard Publication 1, November 1968).

(4) American National Standard Vocabulary for Information Processing. X-3.12-1970. (FIPS PUB 11, December 1970).

(5) American National Dictionary for Information Processing. American National Standards Institute, in preparation.

(6) American Standard
Typewriter Keyboards
ASA X4.7-1966.

(7) American National Standard
Alphanumeric Keyboard Arrangements Accomodating the Character Sets of ASCII and ASCOCR.
American National Standard X-4.14-1971.

(8) Calendar Date
FIPS PUB 4
November 1968
U.S. Department of Commerce
National Bureau of Standards

(9) States and Outlying Areas of the United States
FIPS PUB 5-1
November 1968
U.S. Department of Commerce
National Bureau of Standards

(10) Counties and County Equivalents of the States of the United States
FIPS PUB 6-1
June 1970
U.S. Department of Commerce
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16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)

User access procedures to information systems have become of crucial importance with the advent of computer networks, which have opened new types of resources to a broad spectrum of users. This report surveys user access protocols of six representative systems. Functional access requirements are outlined, and implementation of access procedures is analyzed by means of a common methodology.

Qualitative assessment of standardization possibilities identify standardization candidates such as: system and user signals, on-line user entries, system requests, and network wide categories of message content.

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