What I've been up to lately

Jean -- Thanks for your reply. We would be pleased to receive the documents you mentioned when they are available. We would also be happy to discretely review draft copies if desired. I have asked Susan Poh for a copy of her report via network mail (which at last look was still queued -- if you read this, please ask her again for me). The attached DRAFT report is representative of what I have been up to. Other reports you may wish to glance at are available in the journal at 18385 and 18387.

NETWORK MANAGEMENT SURVEY

by

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What I've been up to lately

Introduction

This report presents some of the results of a study of management practices in different computer networks conducted by the Institute for Computer Sciences and Technology, National Bureau of Standards. The approach to management taken in this report is positive (i.e., reporting on current practices as they exist); the normative approach is taken in a separate report by a different author.

This survey is meant to be representative and illustrative rather than exhaustive or conclusive. The networks covered were chosen to be typical of different approaches to network implementation and management.

The ARPA network is a large distributed network of autonomous, heterogeneous computer systems. It has focused on the development of network technology and resource-sharing techniques, rather than network organization.

MERIT is a controlled experiment in networking on a regional basis with heterogeneous computer systems. Considerable attention has been focused during the network's development on the organizational problems.

TUCC is another controlled regional network, but with homogeneous computers and a larger user base. TUCC has also given considerable attention to organizational issues.

The Oregon State network is representative of many centralized or "star" networks serving a regional clientele.

TYMNET is the only commercial network included in the study. It was desired to include a profit-seeking network in the study, so as to be able to compare managerial practices in non-competitive environments with actual business practices. (Of course, the inclusion of TYMNET in this study in no way implies endorsement of this network).

A common format was employed for presenting the details of each network. The table of contents which follows is an outline for each of the five reports which follow it. Network architecture is separated from network management, and the latter is broken down into a number of different functional areas. This approach was adopted to permit easy comparison of specific managerial concerns from network to network. Some empirical observations from such comparisons are presented in a concluding section which follows the same format as each of the reports.

What I've been up to lately

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ARPA Network

I. Introduction

The ARPA Network is characteristic of large decentralized networks of autonomous computer systems. Its successful operation has been widely publicized in the professional literature and trade press, and has demonstrated the technical feasibility of packet-switching for large networks.

II. Network Identification and General Description

A. Sponsoring Organization

The network is sponsored by the Advanced Projects Research Agency (ARPA), an agency of the Department of Defense concerned with research and development in advanced technology.

B. Purpose/mission of Network

The ARPA Network was begun as a research effort to investigate multiple computer resource sharing and demonstrate the feasibility of packet switching technology.

The network currently operates in support of many ARPA-sponsored research programs by providing access to resources not available locally.

C. Status and Topology

The network has been operational for approximately two years. Figure 1 illustrates the topology of the network as of May 1973. The network currently includes over 30 sites with over 40 independent computer systems connected.

Reliability of the various network components varies widely. Currently the communications subnet of Interface Message Processors (IMPs) and circuits have extremely high reliability, with only occasional outages for particular IMPs or circuits. Since most nodes are connected to at least two other nodes, the outage of a single circuit does not disturb network operation. The service sites are generally less reliable than the subnet, although the statistics vary widely from site to site.

D. Technology Summary

The ARPA Network may be characterized as a distributed store-and-forward network of heterogeneous computer systems (hosts). Hosts are connected to the communications subnet by means of a software interface called the Network Control Program (NCP) and a hardware interface which may have the characteristics of either a channel or a communications line. Each host is connected to a switching center in the subnet called an Interface Message Processor (IMP) which contains an augmented Honeywell 516

or 316 computer; up to four independent hosts may be connected to the same IMP. Each IMP is connected to two or more neighboring IMPs by means of dedicated 50kb communications lines. Host to host messages are passed from the sending host to its IMP, where they are broken into packets and relayed to their destination by the subnetwork of IMPs and communications lines. The routing is adaptive; i.e., the route of any given packet is not established in advance and in general the several packets of a message may follow different routes. The destination IMP will reassemble the message and deliver it to the proper host.

Protocols in the network are constructed according to a layered approach. The lowest level protocol is a binary synchronous communications protocol governing traffic exchange between IMPs. The so-called "first level" protocol governs the logical exchange of information between host and IMP. The "second level" protocol governs the logical exchange of information between Network Control Programs in communicating hosts. The "third level" of protocol refers to any communications occuring between processes in the host machines. Such third level protocols include the Initial Connection Protocol (ICP), data transfer protocol, file transfer protocol, remote job entry protocol, graphics protocol, and others.

A special third level protocol called TELNET defines a network virtual terminal and permits all terminals on the network to provide a similar interface to processes in a separate host computer system. A special IMP which is augmented by the addition of memory and a multiline controller (a specially designed component containing central logic and line interface units) can provide direct network access to terminals without going through a separate host computer system by providing the TELNET function itself. Such an IMP is called a Terminal IMP, or TIP.

III. Network Organization

A. Structure and Extent

Figure 2 illustrates the present organizational structure for the network.

The Advanced Projects Research Agency (ARPA) of the Department of Defense initially conceived and funded the network, and presently directs its operation through the Office of Information Processing Techniques. ARPA is not a large agency, serving primarily as a granting agency, and only several people spend their full time on network activities.

ARPA has turned over the day-to-day operation of the communications network to the USAF Range Measurements Laboratory (RML) at Patrick AFB in Florida. RML will serve as the procurement agent for IMPs and maintenance, and will serve as the focal liaison point for the Defense Commercial Communications Office and the common carriers (see below, III-B-1), Bolt Beranek

and Newman, Network Analysis Corporation, and prospective new users.

Bolt Beranek and Newman (BBN) of Cambridge, Mass. is the primary ARPA contractor in the development and operation of the network. BBN designed and constructed the IMPs and TIPs which comprise the subnet, wrote the software for these processors, and participated in the specification of the network protocols. BBN currently oversees all network modifications, dealing directly with the Bell System for the wideband circuits, and with Honeywell Information Systems for the procurement of H-516 and H-316 processors for inclusion in the IMPs and TIPs. BBN also operates a Network Control Center (NCC) which monitors the operation of the network on a round-the-clock basis and which aids in the diagnosis of failures and initiates and coordinates maintenance efforts.

Honeywell Information Systems is an OEM supplier of basic H-316 and H-516 processors, from which BBN fabricates the IMPs and TIPs. Honeywell field engineers also assist in the installation of these devices, and are responsible for maintenance.

Network Analysis Corporation (NAC), Glen Cove, N. Y., serves as an ARPA contractor for analytical studies to determine the optimum topology of the network and select the topology actually used.

The Network Measurement Center (NMC) is an ARPA-supported research group at the University of California (Los Angeles) which investigates the performance of the network.

The Network Information Center (NIC) at Stanford Research Institute provides a reference center serving to receive, record, index, and transmit, online and offline, information produced by and about the Network. To do this it designs information-handling tools for dialogue and record-handling.

> The NIC currently operates a PDP-10 TENEX system which is used both for development and network services. However, it is planned to separate the development activities from the service functions through an arrangement with Tymshare, Inc.
>
> The involvement with Tymshare is strictly on a "facilities management" basis. That is, Tymshare will operate a computer system virtually identical to the one at the NIC, to provide reliable Tenex, NLS, and Journal service to NIC users and other selected customers.
>
> The NIC staff --- the people who provide the documentation services and dialogue support services --- will remain at SRI, as will the responsibility for further developments in these areas.

Approximately 18 hosts may be classified as research sites. These sites perform research in a number of areas under ARPA contracts and utilize the network in support of their research.

Six sites are classified as service sites: UCLA (360/91), SRI (NIC), UCSB (360/75), BBN (PDP-10), USC-ISI (PDP-10) and MIT (MULTICS). Some of these sites offer services to the network community on a fee basis; others are subsidized by ARPA.

The remaining sites are users, although intersite arrangements are often made for the sharing of resources. Almost all of the sites make some of their resources available, but not all guarantee to interact as a service organization. Each site has a Liaison to answer technical questions, and a Station Agent to handle questions concerning administrative, documentation, and similar questions regarding the network resources and the NIC.

The "network facilitators" are an informal committee of experienced users who proselytize and attempt to solve network problems for users. Other groups that are in a sense "network facilitators" are these special and general interest groups:

ANTS Support Group
ARPANET Satellite System
Computer Based Instruction Group
File Transfer Protocol Interest Group
Imlac Interest Group
International Network Working Group
International Packet Network Working Group
Network Associates Group
Network Graphics Group
Network Information Center
Network Liaison Group
Network Measurement Group
Network Station Agent Group
Network Working Group Steering Committee
Principal Investigators
Packet Radio Group
Remote Job Entry
Speech Understanding Research Group
TIP Users Group
TNLS User Group
TENEX Users Group

B. Functions Performed

1. Planning

Network growth is controlled by the sponsoring agency, ARPA. There does not appear to be any fixed or published policy for determining what sites are to be added. Network growth is limited by the rate at which Honeywell and BBN can supply IMPs.

When a new site is selected, Network Analysis Corporation determines for ARPA the new topology for the subnet. The network topology is not optimized each time a node is added, since that might entail too costly and disruptive alterations of existing circuits, but the new node is added in as

cost-effective a means as possible. Occasionally, more extensive changes are made to the network topology as needs warrant. The planning function is thus centralized and supported by appropriate analysis.

All hardware procurement for the network is controlled by ARPA; the individual sites are not involved. ARPA places orders (through RML) for IMPs and TIPs with BBN. Communications circuits are ordered by ARPA from the Defense Commercial Communications Office (DECCO) which deals with the various common carriers. As explained below, in practice BBN coordinates circuit installation with the carriers.

2. Installation

Each site which is added to the network is responsible for fabricating the interface to the IMP or TIP and for coding a network control program. Specifications for each are available from Bolt Beranek and Newman. The host organization is also responsible for site preparation (floor space, power, air conditioning, etc.) for the IMP, which will reside at the host's own location.

Bolt Beranek and Newman serves to coordinate IMP installation through the Network Control Center. The normal installation team consists of a BBN representative, the person from the local Honeywell office who will maintain the machine, possibly an additional person from the main Honeywell office, and telephone company personnel.

3. Operations

The local host organization is responsible for maintenance of its host processor, NCP and IMP interface. The local Honeywell office will maintain the IMP itself. AT&T long lines division is responsible for maintenance of the modems and communications circuits.

For diagnostic and control purposes, BBN operates a special host system in Cambridge, Mass., which is called the Network Control Center. The NCC regularly receives status reports from all the IMPs in the network regarding the operational status of their communication circuits and their neighbouring IMPs. Special programmable debugging and fault isolation procedures (such as looping lines back into the same IMP) may be initiated remotely from the NCC. Fault isolation may or may not require the assistance of local host personnel.

The maintenance function, which may involve several organizations including the Bell System, Honeywell, BBN and the local host, sounds complicated, but actually isn't. The Network Control Center is very effective in diagnosing failure and coordinating maintenance among the various groups involved.

The division of responsibility for software is similar to that for hardware. All IMP software is controlled by BBN and is currently loaded via the network itself. Host organizations are forbidden to modify the software in their IMPs.

Functional protocols are specified by committees of host, ARPA and contractor personnel. At the lower levels these are fairly well agreed upon and debugged, and hosts agree to abide by them. At the higher levels, the protocols are still evolving, and subsets of hosts often experiment with variants among themselves.

At the present time, all of the lower level protocols are sufficiently well defined and debugged as to be of little or no concern to the average user. The higher level protocols, or more precisely, the lack of generally accepted and debugged higher level protocols (for example, remote job entry) have and continue to be a major hindrance to increased network utilization. More formal direction from ARPA and/or the reestablishment of the network working group (which formulated the lower levels of protocol and then disbanded) to meet on a regular basis might help.

4. User Services

Users at one site seeking to utilize resources at another site are required to be familiar with the characteristics (log-on procedures, operating system commands, program conventions, etc.) of that site. Documentation is, in general, provided by the serving site according to its own conventions. Several organizations do exist, however, to help users access remote resources.

The Network Facilitators Group was an informal committee of experienced personnel at various sites around the country who organized to promote network utilization. This informal group has since been replaced by a group at the Mitre Corporation who have an ARPA contract to assist network users.

The Network Information Center is operated by Stanford Research Institute to facilitate the collection and dissemination of data produced by and about the Network. The NIC maintains online files of data about the Sites and people on the Network, maintains online tools for access to the data, and produces offline notebooks, indexes and directories of the data for use by the Network and other networking agences. The NIC also functions to reproduce, catalog, index and distribute online and hardcopy documents as requested by Network Sites in the process of building and using the Network.

The user support function is probably the least well-provided function in the ARPA network. The quality of documentation and

the general availability of assistance from sites varies tremendously from site to site. The network facilitators help at selected user sites, but because of the informality of their organization and because they are not located at all sites they have not proven to be a general solution. The NIC has not been really effective in distributing all the documentation needed to run at a particular site, let alone enforcing any documentation standards.

C. Interfaces (relationships with other organizations)

The question of the ARPA network's future status has yet to be settled. The network is a closed community, available only to governmental agencies and their contractors, but the network has been connected for demonstration purposes to other (commercial) networks (e.g., TYMNET). The ARPA network is actively functioning as a marketplace for the sale of computer time to the network community.

ARPA has indicated on several occasions that it does not intend to operate the network indefinitely. Several proposals have been submitted to operate the network commercially, but none have received approval. It remains to be seen what the future of the network will be.

In another vein, the technology developed for the network has already received commercial attention. Several companies have filed applications with the Federal Communications Commission to set up an operate similar networks as common carriers (in some cases, using basic communications circuits provided by other common carriers in a so-called "value-added" configuration).

IV. Financial and Legal Concerns

A. Capitalization

The network was funded by ARPA, so capitalization is provided through research grants. ARPA continues to subsidize the subnet communications circuits. Each of the IMPs and TIPs was either paid for by ARPA or the participating host organization. In general, some of the early sites were ARPA contractors, and so had their IMPs provided, while most of the newer sites are users who are paying for their own.

B. Accounting

Participation in the network requires access to the communications subnet and access to individual hosts on the network. IMPs and TIPs are available for a fixed fee from ARPA, which obtains them from BBN. Monthly maintenance charges must be paid after the first year of operation. Communications charges are assessed by ARPA according to usage: a base fee plus a variable fee for traffic above a given minimum. In fact, most network participants

have been supported by ARPA in one way or another, and communications costs continue to be subsidized.

Accounting for resources at the host sites is done by each of the hosts concerned. Each user who desires to utilize remote resources must open an account at the appropriate site. The friendliness of sites to external users varies considerably, as do billing rates. Billing procedures vary widely (some sites have been known to close an account when it ran out of funds without notifying the user) and require using sites to deal with many vendors. The overall situation is recognized to be less than satisfactory, and a committee of principal investigators is currently trying to develop a network-wide accounting scheme.

C. Tariffs

The wideband communications circuits used in the subnet are leased by ARPA through the Defense Department at less than commercial rates. The communications charges assessed to users, even in the absence of subsidies, thus do not represent what "real world" charges would be.

D. Regulation

No commercial users or non-research commercial servers are currently permitted on the network. As a research activity sponsored by the Department of Defense, the network is not subject to regulation by other government agencies (e.g., the FCC).

E. Security

The communications subnet will insure that messages are delivered to the proper host. The non-deterministic routing of the individual packets of a message could be viewed as providing some degree of security to the subnet. At that point it is the responsibility of the host to insure delivery to the proper user.

File security is the responsibility of the individual hosts. Log-on procedures, keyword access and the like are among the procedures employed by the various hosts as protective mechanisms.

In general, the ARPA community does not seem very concerned with user security. Passwords are easily obtained, and it is easy to logon as someone else and inspect (and even alter) his files. There is no checking on the origin of messages to insure that they agree with the identification given in a logon sequence.

V. Conclusions

A. Summary of Problems

Start-up Requirements - Fabrication of the IMP interface and coding of the Network Control Program have been major obstacles to new host joining the network. BBN has fabricated some interfaces,

but prefers not to do so. This problem is expected to continue, as the character of sites joining the network changes from researcher to user. However, a mitigating factor may be the inventory of interfaces and NCPs which have already been constructed.

Cost - The question of cost is growing in importance as the network operation is examined by potential commercial suppliers and as the full costs become known. Published documentation on costs have thus far dealt mainly with the communications subnet. Even here, the costs may be distorted, because the government obtains circuits at a discount and because published figures are derived from loading factors which have never been realized. Also, the cost of network access (an IMP or TIP) remains high (though lower cost replacements are currently under development). However, the most significant concern is that the cost of the subnet may not be the major network cost. Recent studies have shown that the overhead associated with the NCP may be substantially larger than was previously believed. Additional cost studies are indicated, as well as a reevaluation of the current protocol strategy with a view to reducing overhead.

Reliability - In contrast to the now high reliability of the subnet, the host sites, at which the real work is done, vary widely in reliability. Nothing can more surely stifle network success than uncertainty over whether a resource will be available or not when it is needed.

Heterogeneity - Except for the TELNET system, no commonality of operation has been achieved between hosts of different type. Executive level commands are all different, text editors are different, log-on procedures are different, etc. This is a problem which networks have only exacerbated by making additional systems available to potential users.

User Services - The need for readable, accurate, complete and available documentation cannot be stressed too much. Of equal importance, however, is the occasional need for hand-holding. On-line tutorials may provide some relief, but personal assistance by knowledgable and friendly personnel will never be completely replaced by documentation. The current level of these services on the ARPA network is not acceptable.

Protocols - Lack of particular protocols such as graphics and remote job entry has cut off potential usage in some cases. This problem will be resolved as these protocols become better developed and are made generally available.

B. Lessons Learned

In fairness, it must be recognized that the ARPA network began as an experiment in networking among research-oriented sites. It has achieved its objective of demonstrating the feasibility of the packet-switching approach. Many of the problems which have been

identified have arisen as the network matured and the complexion of its participants changed from research-oriented to usage-oriented.

In general, the network has functioned best where there has been formal responsibility and organization, for example, at the Network Control Center. The less directed efforts have been correspondingly less successful, for example, the higher level protocol committees.

One of the clearest areas requiring additional work is that of standardizing the usage of all the systems, possibly by means of some intermediary translator. Perhaps a standard "network control language" is required to facilitate usage of all the different systems involved.

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B. Special Vocabulary

IMP - Interface Message Processor - A specially modified Honeywell 316 or 516 processor which serves as the communications computer in the network.

TIP - Terminal IMP - An IMP which is augmented by additional memory and a multiline controller. The TIP contains a network control program and a TELNET program within it to permit terminals to access the network directly through it.

Multiline Controller - A specially designed multiplexor-like device which supports the access of up to 64 terminals of varying type into a TIP.

Message - A logical unit of data exchange between processes.

Packet - Physical segments of a message which are the transmission units in the subnet.

Subnet - The array of IMPs, TIPs and communication circuits which deliver messages from one host to another.

Network Management Survey - MERIT

MERIT Network

I. Introduction

The MERIT Network is representative of a controlled experiment in networking on a regional basis. The straightforward design of the communications system and the limited size of the network permit attention to be focused on the managerial problems of the network.

II. Network Identification and General Description

A. Sponsoring Organization

In 1966, Michigan State University, Wayne State University and the University of Michigan formally established a program of mutual cooperation known as MICIS (Michigan Interuniversity Comittee on Information Systems). MICIS established a non-profit corporation, MERIT (Michigan Educational Research Triad, Inc.), for the purpose of receiving and distributing funds for research. It is this non-profit corporation which operates the network.

B. Purpose/mission of Network

The Merit Network is a prototype educational computing network that seeks to enhance the educational and computing resources of each university by permitting network participants to share resources. The objectives of the network were broadly stated as gaining, through the development and successful implementation of a network, knowledge about and solutions to the problems of network operation in an established educational computing environment.

The three computer systems in the network are sufficiently different as to make desireable the directing of particular types of work to one of them from the others.

The University of Michigan's system, using duplex IBM 360/67 hardware, was designed especially for timesharing.

The Michigan State University computer (CDC 6500) is unusually fast and therefore well-suited to large, compute-bound jobs.

The Wayne State University Computer Center, with a half duplex IBM 360/67 running the MTS timesharing system, has developed a special competence in administrative data processing.

At the time of organization of the network, a cooperative policy in acquiring special peripheral equipment was considered feasible. It was suggested that relatively unusual equipment, such as a film recorder-scanner, might be purchased by one installation to serve all three universities.

C. Status and Topology

The network became operational in the summer of 1972. The topology of the network is three node, fully connected. Presently the network provides communication service, on a nearly continuous basis, whenever the host systems are up; usage through 1973 has been light, however. Aupperle (1973) reports that current network-use data indicates that between one and two million bytes are transmitted monthly by an average of twenty individual users. About 100 different users have tried the network during the second half of 1972, the first six-month period of statistical data gathering.

D. Technology Summary

The three host systems in the MERIT network are tied together through small communications computers located at each host site, which are themselves interconnected by means of modems through the switched telephone network. The interface which the communications computers present to the host system are uniquely adapted to the requirements of each particular host; the interface which the communications computers present to the telephone network (and thus to each other) are identical. A somewhat novel capability is the ability to dynamically vary the bandwidth of the communications paths available between pairs of hosts. This is accomplished by providing each communications computer with four separate modems and an automatic calling unit. The bandwidth represented by the four lines may be allocated to communications with either of the other two hosts as dictated by immediate communications requirements; normally at least one line is kept open to each other remote site.

The communications computer consists of a standard Digital Equipment Corporation PDP-11/20 with 16K words of 16-bit core memory. Four different types of interfaces are required:

1. Data set interface

2. Automatic calling unit and multiplexor interface

3. IBM 360/67 interface (one for each of two host systems)

4. CDC 6500 interface (for one host system)

The data set interfaces are designed to transfer entire messages over the telephone network directly to and from the PDP-11's core memory without program intervention, once the transfer is initialized by software action. These interfaces are designed to function as either half-duplex or full-duplex units over a wide range of frequencies and are compatible with binary synchronous communications procedures.

Automatic calling unit and multiplexor interfaces provide the communications computer with the ability to dial, under program

control, a single telephone call. The automatic calling unit may be shared among eight telephone lines.

The host interfaces (IBM 360 and CDC 6500), like the data set interfaces, are designed to transfer entire messages without intervention, once appropriate action is initiated. The interfaces transfer data in parallel between the host and the communications computer, and they partially resolve the word length mismatch that exist between these machines. The host interfaces also cause the communications computer to appear as a number of identical, but separate, devices to the host, thus simplifying the logical structure of multiple user activity over the network.

The systems programming requirements for the MERIT computer network consist of device suport for the communications computer in each of the hosts, and an operating system in the communications computer which provides support for the message switching function and an interface to each host. Each host treats the communications computer as an I/O device. Together, the software elements in the host and communications computers permit a user to establish a path to a remote host and to utilize services there. All terminal access into the network is through the local host; there is no direct terminal access into the network which bypasses the local host. However, this capability is being considered for future implementation.

III. Network Organization

A. Structure and Extent

Figure 1 presents a simplified view of the organization of the MERIT Computer Network.

The Michigan Interuniversity Committee on Information Systems (MICIS) is made up of representatives from each of the three participating universities. A few are computer experts, but most are not. MICIS members in turn are responsible for selecting the Director of the MERIT Computer Network.

The MERIT Computer Network project director is responsible for the orderly execution of all of the technical and contractual responsibilities, broadly divisible into three, staff supported functions:

1. Educational and promotional;

2. Research and technical development of the network; and

3. Financial administration.

For the initial phase of network design and construction, MICIS chose a computer expert to lead the work. The director's office is located at the University of Michigan.

In the educational and promotional functions, the director is assisted by three associate directors, one located at each campus. The associate directors are chosen by the director from nominations made by the universities. The special responsibility of each associate director is to promote and encourage the development of the network within his own community of users. He has esentially a dual role: to support the director and the network so that the implementation of the network at his particular site proceeds as efectively as possible, and to insure that his own university's interests are equitably served with respect to the demands made on its resources by the network. The associate directors have no direct responsibility for the technical details of the project, but they are kept informed of relevant developments and provide advice.

Four groups are concerned with the technical research and development function: the Network Central Staff, and the separate Network-Michigan State University, Network-University of Michigan, and Network-Wayne State University staffs individually affiliated with their respective host sites. Further, the Network Central Staff has two components: the senior staff with technical responsibility for all of these groups, and the programming staff, charged with developing software for the common part of the network. At the peak of activities, approximately the equivalent of 12 full-time engineers and systems programmers were involved in this facet of the project. This number represents (equivalently) two systems programmers located at each of the three campus computing centers and six members of the Network Central Staff located at MERIT headquarters.

Wayne State University acts as fiscal agent for the network, fulfilling such functions as the receipt of funds from several sources, the distribution of these funds to the various MERIT groups and vendors, and the preparation of all contractural and budgetary material.

B. Functions Performed

1. Planning

Long range planning responsibility rests with MICIS, which continues to function as a committee and currently meets on a bimonthly schedule. Each university has appointed several representatives, officially four, to MICIS for an indefinite term. The representatives from each university consist of one high-ranking member of each university's administration and of faculty members, usually including the computing center director and others interested in computer application areas.

In its efforts to develop a computer network, MICIS sought both state and federal support. A three-member Joint Executive Committee was established by the participating universities to administer any funds provided by the State of Michigan. Further, in the fall of 1966 the Michigan Educational Research

and Information Triad (MERIT) Inc. was created with its three man Board of Directors, and charged with the responsibility to solicit and receive non-state funds for the network. Wayne State University was designated as the fiscal agent for all state and non-state funds.

Once funding was assured, a network research and development project was established and work began in July 1969. Initially designated the Tri-University Computer Network, it later became known as the MERIT Computer Network Project. Thus the director of the MERIT Computer Network Project submits budgets for approval to the Joint Executive Committee and the Board of Directors of MERIT, Inc. (the same three people serve on both boards) whereupon the fiscal agent executes the appropriate contractural operations.

2. Installation

The special communications facilities for the network were developed by the project staff under the guidance of the Director. This development included communications computer hardware and common software. Software specific to a particular site, and all software residing in the host computers, is the primary responsibility of each host site's staff. A common design for network software was developed by the central project staff.

The Associate Director at each of the participating universities is responsible for matters relating to the installation of the network facilities at his site.

3. Operations

Day-to-day management responsibility for the network rests with the Director and his staff.

The MERIT staff is developing procedures to closely monitor the performance of the network. Statistics gathered on message errors, traffic distribution, and overall throughput will significantly help in adapting the original network design to actual usage patterns. Moreover, a study of machine utilization should facilitate the development of an equitable interuniversity rate structure.

4. User Services

Responsibility for promoting the network within each of the member universities and for providing the required user services rest with the associate directors.

The distribution of system documentation throughout the user community is the joint responsibility of MERIT and the individual universities. At the present time, MERIT disseminates information relevant to the design and operation

of the communications subsystem and its interfaces. Each university is required to maintain and distribute its local facilitys documentation and is responsible for issuing notices reflecting any significant changes.

C. Interfaces (relationships with other organizations)

As explained below, the MERIT network was funded by the Michigan State Legislature and the National Science Foundation. While this has not received much attention in the open literature, it is clear that the network will need to be responsive to the wishes of the Legislature. Along these lines, it is the intention of the network's developers to provide the capability for network access by many of the smaller colleges and universities in the State of Michigan without host computers.

IV. Financial and Legal Concerns

A. Capitalization

The Merit Computer Network was funded, initially for two years, by the Michigan State Legislature, the National Science Foundation and each of the participating universities. The Michigan State Legislature provided in successive appropriation bills the total sum of $400,000, provided that matching support could be obtained from other sources. By the end of 1968, a proposal in the amount of $400,000 was submitted to and subsequently funded by the National Science Foundation.

B. Accounting

The Director and the Joint Executive Committee of MERIT have focused much attention on the accounting difficulties encountered in even so controlled a network as this. The MERIT network follows the basic policy of permitting each site to set prices and charge for services individually. The problem is not in getting sites to offer resources for sale, but in convincing management at each of the sites to permit usage of resources at other sites. The problem is that the possible "balance of payments" deficit (excess of outside use by local users over inhouse use by outside users) cannot be predicted in advance, and therefore is very difficult to budget for, especially on a normal annual basis.

In MERIT's case, relief was sought and obtained from the universities' administrations to pledge, from sources other than the computing budgets, an amount of monies to protect the potentially unbalanced budgets of the wholesaler (local university computer centers) due to the presence of the network. By so doing, a deterrent to utilization was removed.

C. Tariffs

Communications between sites in the MERIT Computer Network

currently utilize a pre-existing, inter-university, voice-grade telephone network.

D. Regulation

The MICIS and the MERIT efforts have been formally approved by the Michigan State Legislature, the State Board of Education, and the governing boards of each of the three universities.

E. Security

No special security procedures have been developed for the MERIT network beyond the normal access control mechanisms for the individual host systems. However, all users of remote resources presently must be validated by their own system as well as the remote system, since there is no access to the network other than through a local host.

V. Conclusions

A. Summary of Problems

The most publicized issue in the MERIT network has been the budgeting problem: getting the computer centers of the three universities to budget for possible net deficits in network usage (excess of work sent to other nodes over work taken in) for a period greater than a single calendar year.

With this problem apparently solved (as explained in IV-B), the main problem has been insufficient network usage to justify its existence. It appears that the three participating universities each have sufficient computing resources to satisfy local needs, so that there is no compelling reasons to use the network. Also, the double charges for use of the network (charges by both the local and the remote system) tend to discourage network usage. This problem could be solved by the expansion of the network to include additional user-only and terminal-access sites in the state, as the network developers envisioned.

B. Lessons Learned

One important lesson to be learned from the MERIT experience is that organizational and managerial problems can frequently overshadow technical problems in the development of a computer network.

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B. Special Vocabulary

CC - Communications Computer, the PDP-11 based front-end computer which provides a common network interface for host systems.

MERIT - Michigan Educational Research Triad

MICIS - Michigan Interuniversity Committee on Information Systems

Network Management Survey - TUCC

Triangle Universities Computation Center (TUCC)

I. Introduction

TUCC is an example of a successful cooperative venture in regional networking by independent and autonomous universities.

II. Network Identification and General Description

A. Sponsoring Organization

The Triangle Universities Computation Center is a non-profit corporation which is owned by the three universities who cooperatively sponsored its establishment -- Duke University, North Carolina State University and the University of North Carolina at Chapel Hill.

B. Purpose/mission of Network

The network has three primary goals:

1. To provide each of the institutions with adequate computational facilities as economically as possible;

2. To minimize the number of systems programing personnel needed; and

3. To foster greater cooperation in the exchange of systems, programs and ideas among the three universities.

Services include educational, research and administrative computing services for the three major universities, about fifty smaller schools and several research laboratories.

C. Status and Topology

TUCC is essentially a centralized, homogeneous network comprising a central service node (IBM 370/165), three primary job source nodes (IBM 360/75, IBM 360/40, IBM 370/135), 23 secondary job source nodes (leased line Data 100s, UCC 1200s, IBM 1130s, IBM 2780s, and leased and dial line IBM 2770s) and about 125 tertiary job source nodes (64 dial or leased lines for Teletype 33 ASRs, IBM 1050s, UCC 1035s, etc.). Figures 1 and 2 illustrate respectively the topology and geography of the network.

Services to the TUCC user community include both remote job entry (RJE) and interactive processing. Thruput has grown from about 10,000 jobs per month in 1967 to about 80,000 jobs per month in 1972. (This increase in thruput was accomplished by hardware upgrades during the period). At the present time about 8000 different individual users are being served directly.

D. Technology Summary

TUCC operates a 2-megabyte, telecommunications-oriented IBM 370/165 using OS/360-MVT/HASP and supporting a wide variety of terminals (see Figure 3).

The three universities are connected to the TUCC by means of Telpak A (40.8 K baud) circuits which connect the universities' primary remote batch terminals to the central facility. In addition, over 50 educational institutions are linked to TUCC by a variety of medium and low speed lines which cover the state and extend as far as Elizabeth City, Wilmington and Ashville.

All local node computers are of the same manufacture as the central facility, and provide local computing services and teleprocessing services (from the central facility). None of the local nodes provide computing services for remote users at this time, but plans for such service are under way.

III. Network Organization

A. Structure and Extent

The network is characterized by an organization which provides both for centralization of certain functions and the retention of freedom and authority by the individual computing centers to operate in the academic environment.

TUCC Organization

The TUCC Corporation is governed by a board of directors whose nine members represent the three major universities. The three members from each university represent the administration, computer science instruction and computer users. The board members are appointed by the executive officers of each institution. The board meets once a month to act on matters of general policy. Other attendees to board meetings are the President and Director of TUCC, the Associate Director and System Manager, the Campus Computation Center directors and the Director of NCES (see section C below). Most questions are decided by simple majority vote of the board, except that questions of "fundamental importance" are decided by each university delegation casting a single vote. Questions of "fundamental importance" include selection of the TUCC President, the annual budget and major equipment decisions.

TUCC Staff

The central staff organization is shown in figure 4.

Systems Programming Section

This section is responsible for development, testing, integration and implementation of all TUCC and

manufacturers' system software. The section is headed by a systems manager who is also the primary technical liaison between the campus computation centers and the manufacturers' field and systems engineering organization. The systems manager serves as an Associate Director of TUCC.

Information Services Section

This group is responsible for the collection and dissemination of documentation to users, campus center staff, directors and the Board of Directors. Most documents are prepared throughout the network organization, including the documentation services section. These documents are edited, approved and published by this section. The section is also responsible for maintaining the program library, for documentation standards, for public relations and visitor liaison, for a periodic newsletter and for general interest brochures.

Development Section

This group is concerned with generation of new versions of the operating system, maintenance of the manufacturer supplied operating system, designing and programming of software interfaces between TUCC-written programs and the operating system, and creation of utility programs needed in the TUCC environment. The group is also responsible for design, programming and installation of monitors, statistics gathering programs for performance evaluation, and for the evaluation of overall systems performance.

Teleprocessing Section

The primary responsibility of this section is maintenance of the teleprocessing software. It maintains current knowledge of all terminals and plans and acquires new communications hardware as required. The teleprocessing manager also acts as a consultant to the campus centers and to individual users.

Operations Section

This section is concerned with the day-by-day operations of the computer room. It also maintains the systems accounting records and prepares programs on systems usage, efficiency and turnaround statistics. It provides liaison with manufacturers' field engineers and with the campus computation center operations managers. It is also responsible for security.

B. Functions Performed

1. Planning

Once per month the campus computer center directors meet with the TUCC director, systems manager, and director of information services, primarily to discuss operational policies and procedures. Charging policies and changes to the billing algorithm are among the topics determined at the directors' meeting.

The TUCC systems manager and the systems programmers of the central staff and of the universities meet monthly to discuss plans for new systems additions and/or modifications.

2. Installation

As described in III.A above, all planning and control over equipment installation at TUCC is performed by the central management. Each university's computer center management performs these functions for their own center.

3. Operations

Each university computer center is autonomous and is operated by its own staff. The TUCC is operated by a separate staff reporting to the central management.

4. User Services

Considerable attention has been devoted throughout the TUCC organization to the provision of adequate user services. Although there is some information dissemination from the central organization in the form of regular newsletters, the wholesaler-retailer organization insures that most user services are provided by the local computer center. This facilitates user access to these services and insures responsiveness on the part of the providers.

In the case of the small institutions served by NCECS, these services are provided by "circuit riders" who visit the schools on a regular basis. Schools are visited as needed and geographically close visits are usually coordinated. Consulting services are assisted by in-WATS telephone lines and personal contacts of remote users at workshops or through visits to the central facility. Data lines can also be used for voice transmission when not otherwise in use. Some use is being made of inquiries being sent by terminal communications to the central computer to be answered by the central staff.

C. Interfaces (relationships with other organizations)

The North Carolina Educational Computing Service (NCECS) was created as a state agency by the Board of Higher Education in

1969. (NCECS is the successor of the North Carolina Computer Orientation Project (NCCOP) which began in 1966). Its mission is to provide educational services to institutions throughout the state. NCECS provides technical support and consulting to small users. This includes computing services (terminals, communications and computer time) as well as technical support (information services, technical assistance to users, specialized software and documentation).

The director of NCECS represents his organization at TUCC board meetings in a non-voting capacity, and also attends meetings of the computer center directors. Close geographic co-location (in different wings of the same building) help intercommunications between the two staffs, although the organizations are totally independent.

The NCECS staff includes both state supported and project supported positions. Nine positions are state supported: the director, his secretary, administrative assistant for curriculum development, manager of user services, three computing consultants, an information services officer and a business officer. Grant supported positions include curriculum development manager, programmer for curriculum development (half-time) and systems programmer (half-time).

The main function of the staff is the increase and improvement of involvement of the participating schools in computing. Two full time and one half-time "circuit riders" and a manager of user services deal directly with the needs of the outlying institutions, as explained above (III-B-4).

IV. Financial and Legal Concerns

A. Capitalization

Initial grants were received from NSF and from the North Carolina Board of Science and Technology, in whose Research Triangle Park building TUCC was located. These funds, along with the contributions from the founding universities, served to establish TUCC.

B. Accounting

The accounting system for TUCC is based on a wholesaler-retailer concept. TUCC is a wholesaler of computing services, including machine cycles, operating system, programming languages and application programs, a documentation service, and management. The TUCC wholesale service specifically does not include typical user services -- debugging, contract programming, etc. Nor does it include user level billing nor curriculum development. Rather, these services are provided for their constituents by the campus computation centers and NCECS, which are retailers for the TUCC Network.

The wholesaler-retailer concept can also be seen in the financial and service relationships. Every two years the founding universities negotiate with each other and with TUCC to establish a minimum financial commitment from each to the net budgeted TUCC costs. Then, on an annual basis the founding universities and TUCC negotiate to establish the TUCC machine configuration, each university's computing resource share, and the cost to each university. This negotiation includes adoption of an operating budget. Computing resource shares are stated as a percentage of the total resource each day.

Each of the three universities and NCECS currently pay 25% of the TUCC budgeted operating costs and are each entitled to equal amounts of service. A scheduling algorithm with a "usage leveling capability" allocates resources to the institution which has used the least so far. Each institution funds its own computer facility and communications lines. Each institution bills local users based on payments made to TUCC and on detailed usage statistics collected at the central computer.

TUCC charges a wholesale rate to the three universities which is a little lower than the rate charged to NCECS. The justification for this procedure is the fact that the income from the universities is guaranteed while the income from the NCECS is less certain. Both the computing centers and the NCECS levy additional charges on the local user to cover local computing center costs and the costs of the additional NCECS central staff.

C. Tariffs

Since the TUCC network does not extend outside the state of North Carolina, intrastate tariffs apply for all communications facilities. Standard telephone company services are utilized for wideband and voice grade circuits.

D. Regulation

No direct Federal or state regulations apply to the TUCC network. However, the state of North Carolina can exert influence over the network through the Board of Higher Education.

E. Security

No special attention has been given to security in the TUCC network beyond those measures normally found in a third-generation operating system for the control of access to files.

V. Conclusions

A. Summary of Problems

Administrative Data Processing

TUCC has for some time been handling the full range of

administrative data processing for two NCECS universities and is beginning to do so for other NCECS schools. The primary reason that this application lags behind instructional applications in the NCECS schools is simply that grant support, which stimulated development of the instructional applications, has been absent for administrative applications. However, the success of the two pioneers has already begun to spread among the others.

With the three larger universities there is a greater reluctance to shift their administrative data processing to TUCC, although Duke has already accomplished this for their student record processing. One problem which must be overcome to complete this evolution and allow these universities to spend administrative computing funds on the more economic TUCC machine is the administrators' reluctance to give up a machine on which he can exercise direct priority pressure. The present approach to this problem is to extend to allocation and scheduling algorithms to guarantee a portion of the central machine to each founding university's administrative data processing needs. This would probably require additional computing resource at TUCC.

Hardware Homogeneity

While not a real problem at present, it would appear that TUCC has locked itself into IBM compatible systems. This has simplified the development of the network by permitting compatibility problems to be ignored, but it may restrict the alternatives for future growth.

B. Lessons Learned

1. User Services

A very important lesson that was learned is that personal communication must exist and be kept alive at all levels.

> "It is amazing how misinformation can spread if there does not exist a vigilant system for keeping people informed... Experience has shown us that if we relax ..., then little things that may go wrong may sometimes be magnified completly out of proportion to their importance and begin to become a source of irritation at some point in the system. The central facility must therefore have a high coefficient of sensitivity to the needs of all users."(Davis, p. 4-1-2)

The earliest recognition of this fact was the hiring, at the time of the formation of TUCC, of a Manager of Information Services at TUCC. His responsibility is the documenting of all operating systems, services and policies. An elaborate system of memoranda series with distributions to various relevant groups was developed. This lesson also explains the "circuit

riders" who were employed by NCCOP (now NCECS) to regularly assist its client colleges.

2. Wholesaler-Retailer Concept

TUCC's implementation of the wholesaler-retailer concept (as explained in section IV-above) was designed as a mechanism for the administrative protection of the interests of the three founding universities and the NCECS schools.

Because each of the universities and NCECS is guaranteed a minimum percentage of utilization of the central machine (in effect, a virtual machine for each), they have the assurance that they can take care of their users' needs as would be the case with totally independent facilities. The scheduling algorithm also allows each to define and administer quite flexible, independent priority schemes.

Since the local centers and NCECS are the retailers of all computer services, whether produced locally or purchased on a wholesale basic from TUCC, they are not in competition with TUCC. Users are also able to turn to local personnel for all required services, and receive a single bill.

There are several structural devices which serve to protect the interests of both the wholesaler and the retailers. At the policy making level this protection is afforded by the Board of Directors, which is appointed by the Chancellors of the three founding universities. Typically each university allocates its representatives to include its business interests, its computer science instructional interests, and its other computer user interests. The University Computer Center Directors sit with the board whether or not they are members, as do the Director of NCECS and the President of TUCC. An example of the policy level function of the Board is their determination, based on TUCC management recommendations, of computing service rates for NCECS and other TUCC users. (Williams, 1972)

At the operational level there are two important groups, both normally meeting each month. The Campus Computation Center Directors' meeting includes the indicated people plus the Director of NCECS and the President, the Systems Manager, and the Assistant to the Director of TUCC. The System Programmers' meeting includes representatives of the three universities, NCECS and TUCC. In addition, each of the universities has the usual campus computing committees.

3. Neutrality of Site

The neutral location of the central computer is felt to be "one of the chief factors contributing to the political stability of TUCC." (Brooks, et. al.) An earlier unsuccessful experience with a computer jointly owned by NCSU and UNC-CH, but located at Chapel Hill, had shown that "the psychological and political

consequences of location could not be tele-processed away." It is recognized that a neutral location requires extra cost, but this is felt to be "an indespensible expense."

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B. Special Vocabulary

NCCOP - North Carolina Computer Orientation Project

NCECS - North Carolina Educational Computing Service

TUCC - Triangle Universities Computation Center

Oregon State Regional Network

I. Introduction

The Oregon State Regional Network is representative of a large number of centralized "star" networks serving a regional clientele. It was organized to provide educational computing services to a number of geographically dispersed institutions, and is not concerned with research into the technology of networking.

II. Network Identification and General Description

A. Sponsoring Organization

The network was sponsored by Oregon State University with support from the National Science Foundation.

B. Purpose/mission of Network

The regional network was established in connection with a two-year project with National Science Foundation support to develop and appraise instructional uses of computational facilities provided through computer terminals on-line to a central computer facility. The objectives of the project were:

1. To provide faculty and students at the participating colleges with computing resources available through terminals which have direct access to a central computing facility.

2. To develop special instructional programs and materials suitable for regular as well as "short" courses in the use of computers in an educational environment.

3. To appraise the usefulness in instructional programs of the facilities offered with reference to the instructional needs of each institution.

C. Status and Topology

The system now supports a network of more than 200 remote terminals with approximately 75 terminals active concurrently. Approximately 35 terminals are located at other universities and colleges of the network. The network serves instructional, administrative and research aplications, and may be reaching saturation. Acquisition of new computing hardware is being contemplated at the present time.

D. Technology Summary

The Oregon State University Regional Computer Network consists of a central computing facility at the Oregon State University campus in Corwallis, Oregon, which serves some sixteen institutions of higher learning in Oregon. The central facility runs in a time-sharing mode under a special operating system developed at

Oregon State University. Remote users are connected to the central facility by low speed teletype lines.

The principal resource at the computation center is a CDC 3300 with a memory capacity of 98K 24-bit words. Peripheral devices include a card reader and punch, line printer, four magnetic tape units, five magnetic disc units, a 200 million character mass storage disc unit, 16 CRTs, a plotter and a PDP-8 minicomputer which serves as a communications front end. The PDP-8 also serves as a telephone line interface for 180 remote terminals. During 1972 remote batch capability was added using card readers and line printers.

The operating system, OS-3 (Oregon State Open Shop Operating System) was designed and implemented by the Oregon State Computer Center. It permits time sharing operation in a variety of languages, including ALGOL, FORTRAN, BASIC, OSCAR (a conversational language for all types of users), EDIT (a file editing language), and others.

III. Network Organization

A. Structure and Extent

The organization of the network is embedded in the organization of the regional computer center. Special organizational elements, exclusively concerned with network operations are a regional coordinator who reports to the regional computing center director, a regional steering committee, and campus coordinators resident on the individual campuses. Close liaison is maintained with the Teaching Research Division, an arm of the Chancellor's Office, which represents all institutions of the Oregon State System of Higher Education.

Computer Center Director

The regional computing facility is under the direct supervision of a central administrative officer, the computer center director. He has the authority to enforce adherence to established procedures, observation of priorities, and conformance to established schedules. The director is assisted by a steering committee.

Steering Committee

The regional steering committee considers policy matters affecting regional projects, terminal end users, and recommends action to the regional coordinator and the computer center director. The committee helps to maintain uniformity and workability of operation and services, where this is in the interest of participating institutions. It acts as a developer of procedures for network users. It is responsive to all network participants and considers the effects of all actions

on local centers. Members are elected to the steering committee by the participating schools.

Campus Coordinators

The campus coordinator acts as the manager of instructional computing on his individual campus. He needs to have a knowledge of available computing facilities and of specific campus computing needs. He works closely with all users and coordinates interdiciplinary request and problems. This assignment is considered to require at least half time availability of the designated faculty member. Specific functions of the campus coordinator are:

Coordinate use of remote terminals with local facilities;

Act as campus-wide focal point for utilization, dissemination and facilitation of instructional and research uses of the regional computing facilities on his campus;

Serve as a member of the local institution computer committee;

Facilitate training for faculty;

Coordinate remote regional facility maintenance, regional staff visits and workshops;

Attend regional conferences;

Report development of computer-related curriculum material and other documentation to regional project coordinator;

Prepare and coordinate interim and annual reports regarding institutional participation in the network;

Report news items to regional newsletter editor;

Be aware of all projects involving curriculum development teachers, curriculum writers, consultants and learning and evaluation specialists;

Participate in local budget recomendations involving utilization of regional facilities on his campus.

The final project report recommended that the campus coordinator report to either the dean of instruction or the dean of administration. It was also suggested that on some campuses it would be beneficial for the Campus Coordinator to have an advisory committee to assist him in making decisions relating to the allocation of resources.

B. Functions Performed

1. Planning

The emphasis during the initial portion of the project was on three items: 1) developing useful and reliable services; 2) assisting individuals and classes to become fully cognizant of the services and how they could be used; and 3) a preliminary exploration of the curricular changes brought about by the introduction of the facilities. The emphasis throughout the last year of the project was on the development and evaluation of techniques and materials relating to the role of computers in the academic environment.

2. Installation

The time-sharing computer facility of the OSU Computer Center has been the basic computational resource of the network. Access to the center is through remote terminals located at each of the participating colleges. Under the grant they wre provided with terminals, communications costs, computer time, and consulting services. The installation requirements for this type of arrangement are minimal.

3. Operations

Because of the star configuration of the network, operational concerns specific to the network are minimal. The center is operated as any other large multiprogrammed center serving interactive users.

4. User Services

User services have primarily been provided by three means: publications, seminars and personal interaction.

Publications include manuals for all services available as well as a computer center newsletter published on a regular and timely basis. These are necessary but not suficient to the success of the project.

In an effort to promote the use of the network, a series of conferences were held at various campuses to introduce the faculty to some of the instructional uses that can be made with the computer in the classroom. Each conference lasted two days and concentrated on a specific academic area. The participating faculty were presented with ten to fifteen examples of actual classroom uses of the computer followed by an opportunity to use the material and to modify and adapt some of the examples into their instruction. Whenever possible, each example was presented by an instructor who had used the material in his class, and Regional Computer Center staff were on hand to help the faculty with any problems they had in using the terminal, the system or the

materials. The faculty attending the conferences became very enthusiastic about the possibilities of the computer in the classroom. However, it was found that without some type of follow-up the enthusiasm wanes.

The follow-up is provided through personal interaction. A Regional Computer Center staff member, familiar with the academic area and the instructional materials, visited the participating schools during the immediate weeks following the conference. He discussed with the faculty who attended the conference and other interested faculty possible applications in their classrooms. The role of the local campus coordinator in providing personal assistance has already been discussed. Within the course of one term, following this procedure, the faculty who have attended the conferences introduced the computer into their classrooms on a regular basis.

C. Interfaces (relationships with other organizations)

The regional computing center has worked closely in the past with the Teaching Research Division, an arm of the Chancellor's office which represents all institutions of higher learning in the Oregon State System. This division is concerned with inprovements in the teaching procedures at various levels of instruction. The division has assisted in two areas: 1) direct assistance to faculty in courses using computers, and 2) evaluation of user reaction, utilization patterns, and impact of the computer on instruction.

The other external relationship of interest is with the other universities involved in the CONDUIT project. Oregon State University, Dartmouth College,the North Carolina Educational Computing Service, and the Universities of Iowa and Texas have been funded by the National Science Foundation in a coperative project in educational computer usage and program exchange. Each of these schools have developed active computer networks and a significant base of curriculum materials. The CONDUIT project involves the formation of a central organization and staffs at each of five schools to design the procedures necessary to transport about 75 curriculum units and to implement these procedures in the five networks. CONDUIT will quantify this exchange process including all costs, faculty training requirements and user feedback.

IV. Financial and Legal Concerns

A. Capitalization

The National Science Foundation, through its Office of Computing Activities has funded 20 regional computing activities during the period 1968-1969. One of the first three such grants made was to Oregon State University in 1968 in cooperation with six other colleges in Oregon. The principal investigator under the grant

was Dr. Larry C. Hunter of OSU. This grant has since expired, and current network activities are self-supporting. Campus computer center operations are supported by the local university budget. The regional center is supported by state funds and usage charges.

B. Accounting

Because of the "star" configuration of the network, accounting was not a problem. All users maintained accounts in the central machine at OSU and were billed (or charged against their portion of the grant) from there.

C. Tariffs

Since all participants of the network were located within the state of Oregon, intrastate tariffs applied for all telephone lines used. The network was configured as a "star" or single central timesharing system with remote users, so there were no other issues related to tariffs.

D. Regulation

The network was regulated in part by the National Science Foundations by the terms of its grant and in part by the Chancellor's Office of the State of Oregon. Only institutions of higher learning in Oregon could participate.

E. Security

The only security controls in the system are provided by the log-on sequence of the central time-sharing system.

V. Conclusions

A. Summary of Problems

Due to the use of a well-known and straightforward network design (the star configuration) and the emphasis on providing service rather than performing research on networking, there were no notable technical problems. The primary problem was in promoting the use of the facility by those to whom it was offered.

B. Lessons Learned

The projects final report suggested that the success of a regional computing activity required quick and effective methods of communication between the remote site and the central staff. The following general principles were offered:

1. There must be a willingness of regional participants to work out mutual problems, to cooperate, to compromise if necessary, and to consider the progress of all users.

2. A regional center should be considered a service

organization to provide services which cannot be provided efficiently otherwise.

3. The activities of the regional group are under a steering committee which considers policy matters affecting regional projects, terminal use and users, and recommends action to the Regional Coordinator and the Comouter Center Director.

4. The Regional Steering Committee can help to maintain uniformity and workability of operation and services.

6. The regional facilities and activities should augment each schools local facilities and services. The use of the terminals and facilities on each campus should be under the jurisdiction of that school and operated for that respective school.

7. Location of regional facilities is of little concern. More important is ease of access, reliability and personal service.

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B. Special Vocabulary

OS-3 - Oregon State Open Shop Operating System

OSCAR - Oregon State Conversational Aid to Research

TYMNET

I. Introduction

TYMNET is a distributed national network of heterogeneous computers operated for profit by a major time-sharing company. The continued operations of this network serves to demonstrate that such facilities are commercially viable.

II. Network Identification and General Description

A. Sponsoring Organization

Tymeshare, Inc., with headquarters in Cupertino, California, was formed in 1966 as a commercial time sharing company. It has grown to a company with annual sales of some $16 million and about 300 employees, making it the largest independent in the time sharing field. The total number of individual users of Tymshare services is in excess of 10,000, and they represent over 150 separate organizations.

B. Purpose/mission of Network

TYMNET exists primarily to make available the commercial timesharing services of Tymeshare, Inc., although the capabilities of the communications network itself have been marketed separately to customers wishing to connect their own terminals to their own computers. The network is designed for interactive terminal to computer communications, although computer to computer connections are possible.

C. Status and Topology

The network has been operational since 1969 as a commercial service. It is presently serving over two thousand interactive users (800 simultaneously) in over 70 cities throughout the United States and Europe (Paris, France).

The network serves to interconnect approximately 30 host computer systems and contains some 80 communications nodes in a multi-ring configuration. Figure 1 illustrates an abbreviated topological map of the network.

D. Technology Summary

The network consists of approximately 80 minicomputers (Varian 620/i) called TYMSATs interconnected by common carrier voice grade facilities. The TYMSATs serve in two different capacities, to connect host systems and terminals to the network.

The "base" TYMSAT is responsible for acting as both a message switching computer in the communications network and as an interface to the network for host or service computers. When the service computer is one of those generally supported by

Tymshare (such as an XDS 940, SIGMA 7 or DEC PDP-10), the TYMSAT has been programmed as a communications controller replacing the standard components for that function. Computers of a type not employed by Tymshare have thus far been interfaced to the net through their standard communications controller (e.g., IBM 270X for an IBM 360 or 370) so that the TYMSAT appears as a complex of terminals to the controller.

The base TYMSATs are each connected to a service computer in a one-to-one fashion (approximately thirty throughout the country) and to one another either directly or through an intermediate base TYMSAT in a multiple ring or distributed manner. The circuits used are either 2400 or 4800 bps synchronous, full-duplex, private leased lines.

The "remote" TYMSATs act as store-and-forward computers and as concentrators for user terminals. In addition, some remote TYMSATs with added hardware and software can suport local printers in the 600 to 1200 baud range. Each is capable of supporting up to thirty-one asynchronous, full-duplex modems allowing for terminal speeds in the 110 to 300 bps range. The remote TYMSAT can identify a terminal (baud rate and carriage return delay time) by the first character typed. It is possible to allow a terminal to connect with two different baud rates for input and output. In addition, ASCII conversion is provided for non-standard terminals and echoing if the user terminal is operating in echo-plex mode.

The remote TYMSATs are connected to the base TYMSATs and thus the service computers through a ring configuration whereby a circuit passes through a number of remote TYMSATs and one base TYMSAT. Store-and-forward techniques are used to exchange information between any remote TYMSAT and any base TYMSAT. The circuits connecting the remote TYMSATs are again 2400 and 4800 bps synchronous, full-duplex, private leased lines.

Blocks are transmitted through the network over full-duplex virtual circuits. These circuits are established at log-in time and exist for the duration of the connection. These circuits are established by software in the TYMSATs which associate an input channel with the appropriate output channel at each switching point. A circuit is established by the "supervisor in active mode" (Sam). When a user connects to TYMNET, he is originally communicating with the Sam, which, after the appropriate exchange of information, will establish a circuit from that user's terminal to the desired service computer by selecting the proper TYMSATs to complete the virtual circuit.

The "supervisor in active mode" is so named because it is a function which can be taken over by backup supervisors in the event of failure. A backup supervisor will become active by detecting a failure, polling the TYMSATs to get network status information, and assuming the active role. This sequence does not

disturb users on processors other than the one whose supervisor failed.

It should be noted that in the event of a processor failure, its base TYMSAT can still function in the role of a network store-and-forward computer. Since virtual circuits are established and fixed for the duration of processor connections, recovery from a physical line failure is not as clean. When a line fails, users communicating through virtual circuits using that line in their definition must reconnect.

III. Network Organization

A. Structure and Extent

B. Functions Performed

1. Planning

The network is privately managed in its entirety, and all planning for its growth is done by the Tymshare, Inc. corporate staff. The network topology, however, has not been laid out following any specific design strategy, but has just grown in response to customer needs and the business expected in certain areas.

2. Installation

All matters relating to installation (such as leasing phone lines and the delivery and attachment of TYMSATs) are handled by Tymshare, Inc. as part of the usage contract with the customer.

As usage grows and bottlenecks occur, two main courses of action are taken by Tymshare. As an interim step, the "preferred routing" definitions for some terminals can be changed, so as to reroute data and thus relieve the bottleneck. Also, additional leased lines can be ordered; it normally takes about six weeks to obtain such lines. The ring structure of the network provides considerable flexibility in the management of the physical network.

3. Operations

The network is controlled by a Network Supervisory System. This is a control program that is resident in four host computers. Currently, two of these host computers are at Cupertino, California, one is at Englewood Cliffs, New Jersey, and one is at Paris, France. However, only one of the programs is in control of the network. The other three have a "pecking order" for taking over control of the network, in case the active supervisor shows any sign of not being able to handle the job. If the network should become segmented, such as transmission

across the Atlantic be disrupted, then each segment can be run independently until communications have been reestablished.

The network has proved to be very reliable, with an average of only 1.4 failures per year for the TYMSATs. Preventative maintenance is performed once per year on the TYMSATs.

4. User Services

Tymshare, Inc. has an extensive organization of marketing representatives throughout the country who also continue to provide service to customers after they contract to use the network. The company offers many proprietary software packages for use on the network, and is continuing to develop more.

As a profit-making company, it is reasonable to assume that Tymshare will be quite responsive to user needs. For example, remote batch service is not presently offered, but will probably be added when user demands dictate.

C. Interfaces (relationships with other organizations)

IV. Financial and Legal Concerns

A. Capitalization

Tymshare, Inc. is a for-profit corporation capitalized by the sale of stock to private investors.

B. Accounting

Tymnet can and is being used in several ways. The principal use is for providing customers with time sharing services, both computing services and application packages. The network allows a customer to use a specific resource, such as a particular data file, that may be located at a Tymshare computing center on the other side of the country. In addition, the network allows Tymshare to make "rolling use" of its resources by diverting peak loads occurring at particular hours of the day to computers located in other time zones.

Another use of the network is where the customer has both a computer and terminals connected to the network, and the Tymshare computers do some of the processing. Data files may be exchanged between a user's computer and Tymshare computers as required.

Still another way to use the network is by a joint use arrangement, which is allowed under Federal Communications Commission (FCC) Tariff 260. In this type of usage, the customer contracts for a specified percentage of the Tymnet capacity -- say 1% averaged over a one month period -- for communicating between the customer's terminals and the customer's computer. In this instance, the Tymshare host computers are involved to set up the call routing and to guarantee their stability, but not to process

data. An agreement is signed with the Telephone Company whereby it bills the company for the specified percentage of the communications charges. In addition, Tymshare bills the customer for its "value added" services.

TYMNETs standard price list is as follows:

Description	Monthly Charges
Each log-on to host computer	$ .50
Accumulative time connected to host for all terminals:	
0 to 500 hours	3.00/hour
next 1500 hours	2.50/hour
next 3000 hours	2.00/hour
next 5000 hours	1.50/hour
each hour over 10,000	1.00/hour
Transmission of characters between user and host computer	.125/1000 characters
TYCOM-III rental (30 ports)	2150.00/month
AT&T Joint Use Charge (billed by AT&T)	7.50/leased lines used/month
One time installation charge	1000.00

C. Tariffs

D. Regulation

Aside from tariffs (discussed above) and the normal laws affecting all private businesses, TYMNET is not regulated.

E. Security

V. Conclusions

A. Summary of Problems

B. Lessons Learned

Annexes

A. Bibliography

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B. Special Vocabulary

TYMSAT - a miniprocessor based on the Varian 620/i which acts as a store-and-forward switch and an interface for terminals and computer systems to the network

Conclusions

I. Introduction

The approach to network management taken in this report has been positive, rather than normative. Nevertheless, it is possible to draw some conclusions simply from observing which of several different approaches have been successful. This is the essence of the comparative approach to management. While the conclusions which will be drawn here are not intended to be definitive, they do seem to be indicative of how successful network management is performed. It is in this spirit that they are offered.

II. Network Identification and General Description

A. Sponsoring Organization

B. Purpose/mission of Network

It seems clear that network success, i.e., high user satisfaction and growing demand for network services, cannot be achieved or adequately acertained without there being a real purpose for the network other than just research on networking. Networks faced with real needs to satisfy are more likely to seriously and realistically work out user support problems than networks which would hardly be missed by a significant user community.

C. Status and Topology

There does not appear to be a minimum critical size for achieving success in user satisfaction by a network. Indeed, growth seems to present more stringent demands on network management resources in such areas as user services. Thus for research projects or experiments in networking, small scale efforts with a well-identified user community would seem preferable. Nonetheless, evaluation and measurements would have to be considered in projecting success for an expanded operation.

Topology is important only in that shared facilities should be equally available to all those contributing to their maintenance. Geographic neutrality has been found (in the case of TUCC, for example) to help emphasize this point.

D. Technology Summary

The particular technology employed in constructing a network does not appear to be critical to the success or failure of the network. Speed of lines, routing strategies and similar factors seem not to be significant. Reliability, however, is significant. The conclusion appears to be that users will adapt their usage modes to whatever type and level of service is offered, but they must be confident of receiving this service when it is desired if the network is to be successful.

III. Network Organization

A. Structure and Extent

The main comment to be made regarding the structure and extent of the network management organization is that there SHOULD BE structure and extent. Networks need to be well managed to be successful, and a formal organization is preferred to an informal one in nearly all cases.

B. Functions Performed

1. Planning

The results of the survey seem to indicate that centralized planning is to be preferred over distributed responsibilities. In multi-organizational ventures where the interests of individual parties need to be protected, the centralization of planning responsibility can be vested in a joint team or committee.

2. Installation

The installation of equipment in a well-managed network will be accomplished in a non-disruptive manner and on a timely basis. This can only result from orderly planning, as discussed above. None of the networks surveyed appeared to be deficient in this area.

3. Operations

The main comment to be made about operations is that the degree of reliability which must be built into networks is extremely high -- 95% up time is probably not good enough. Users must have the assurance that the system will be available when they need to use it.

A large measure of this reliability is designed into networks through the techniques of redundancy and standardization. Redundancy, for example, insures that the failure of a single communications link does not isolate any users. Standardization provides a means to switch from processor to processor as required. Additional efforts along these lines are required, but these are not, strictly speaking, operational matters.

The main requirement in the operations area is the ability to rapidly diagnose and respond to failures in the network. The network control center developed for the ARPA network is the most sophisticated example in this survey. Such control centers serve the multiple functions of continually monitoring the network and diagnosing problem areas, coordinating corrective measures, and providing a central point to which users may direct inquiries and complaints.

4. User Services

It is clear that the area of user services is a critical one to the success of any network. It is also clear that a wide variety of services are required, not just good documentation. These services include as a minimum documentation, training, assistance on specific problems, and a channel for accepting user feedback (gripes). Additional services might include network mail and facilities for on-line collaboration.

The experience of the networks surveyed indicates that services are best provided by organizations closest to the user -- e.g., the local retailer. This is because personal services are required, and because a local organization is likely to be more responsive to the needs of local users.

C. Interfaces (relationships with other organizations)

IV. Financial and Legal Concerns

A. Capitalization

The first conclusion to be drawn in this area is that networks require substantial capital, both for the development required and to underwrite the operation of the network while usage is still very light. Since usage may take some time to grow, as users gain both familiarity and confidence in the system, the initial capitalization should be adequate to cover at least two years of operation.

We comment elsewhere in these conclusions that a commitment from users to the success of the network may be a key element in achieving success, especially in a non-commercial network. In this vein, it seems likely that a significant contribution to the network's capitalization by these users would go a long way towards encouraging this commitment. A network in which the users have little to lose in the event of failure is that much more likely to fail.

B. Accounting

Herzog (1973) discusses the accounting problems which must be faced when a network is constructed to interconnect a number of autonomous sites. He bases his discussion on the wholesale/retail concept espoused by Grobstein and Uhlig (1972). The users, of course, are anxious about the prices they must pay for service. The wholesalers (e.g., autonomous university computing centers), whose planning and budgeting experience is dominated by the history of pre-network days, are afraid that some of the income they have anticipated will be diverted to other wholesalers. This potential diversion threatens the budgetary integrity of each wholesaler and results in real anxiety.

Herzog suggests that in the long run, usage patterns can be

incorporated in the budgetary and planning process, thereby reducing the problem to the traditional one of matching the expected and actual income. At the start, however, a cooperating group seeking to obtain the benefits of a network must find a mechanism to overcome this anxiety. Using the total flow of resources across the network as a measure of success, he suggests that the ideal would be to have a large but balancing flow. A zero differential flow by definition avoids the cited anxiety. However, as Herzog recognizes, it is unrealistic and short-sighted to expect that this ideal will be met.

(It could, of course, be met by administrative fiat, but this would create an unstable situation of unsatisfied demand which would be difficult to perpetuate).

In MERIT's case, relief was sought and obtained from the universities' administrations to pledge funds from sources other than computing budgets to cover imbalances. This removed a serious potential deterrent to network utilization. To arrive at this resolution, however, required a careful review of existing internal organizational policies.

C. Tariffs

D. Regulation

Up to the present time, most networks have been able to avoid entanglements in tariff questions through one means or another. However, as networks continue to grow in size and importance, there are likely to be tariff decisions made which will affect networks.

There have been two major issues before the Federal Communications Commission that have direct bearing on computer networks and their required data communications. These investigations covering specialized common carriers and the inter-dependence of computers and communications and the resulting rulings are often confused and considered together. However, as Enslow has pointed out, it is important to realize that they are separate and distinct in their effects on both computer networks and communications.

The major question addressed in the Specialized Common Carrier inquiry, FCC Docket No. 18920, was whether or not carriers other than the presently established ones would be permitted to offer competitive services. The FCC decision, released in June 1971, came almost eight years after MCI first filed for authority to construct a Chicago to St. Louis microwave system; however, the ruling covered all of the applications pending before it. The Commissioners position strongly supported free and competitive entry into the market.

In November 1966, the FCC initiated Docket No. 16979 to examine the "Regulatory and Policy Problems Presented by Interdependence of Computer and Communication Services and Facilities." Another

lengthy study was required before the Commission issued its final order in March 1971. Although all of the items raised in the initial inquiry were not ruled on, there were important decisions made on the regulatory status of publicly offered teleprocessing services. Enslow characterized the decision in terms of a spectrum of service offerings between pure computing and pure communications.

> "Pure" remote computing utilizes communications services, but that use is only incidental to the primary function of the service. It was ruled that this service would be unregulated.
>
> The other end of the spectrum is circuit switching which requires some computation and logical decisions to be made by the switching processor. However, this is incidental to the primary service which is "essentially communications" and therefore fully subject to regulation.
>
> The Commission's ruling also covered message switched service, which, though it requires more computation, is still a "communications" service and regulated. What the ruling did not settle was the status of hybrid services where the "incidental" test fails. The problem was recognized and specified as an area in which advisory rulings could be obtained; however, as Enslow recognizes, the mere fact that the line is not drawn between what is to be regulated and what is not has already served as a deterrent to the offering of new services.

Another regulatory issue that is often raised when networks are discussed is the prohibition against resale or third-party use by an organization that has obtained service from the regular common carriers. This is a problem; however, Enslow suggests that it is becoming less of a problem in the area of data communications. One important feature of data communications networks that distinguishes them from private voice networks is the fact that the service provided by the operator of the network is usually quite different from the facility he obtained from the common carrier. A data communications network will usually provide additional services to its customers such as error correction, automatic routing, testing and alternate routing, and other features such as directory services. Enslow suggests the term "Value-Added Network" or VAN to describe such services, but he points our that the regulatory issues relating to such networks have not yet been resolved.

E. Security

Security is an issue which has been conveniently ignored by most networks, but which will have to be faced by many of them eventually. Security may seem to be of little importance in an academic environment, but even there may be found instances of sensitive files which require adequate protection from examination and tampering (e.g., personnel files, files of student grades).

Networks which offer service commercially have the responsibility to develop measures to protect their customers' sensitive information.

V. Conclusions

A. Summary of Problems

B. Lessons Learned

Annexes

A. Bibliography

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B. Special Vocabulary

Centralized Network - A network with a topology such that all nodes are connected to a single node.

Circuit Switching - The establishment of a physical circuit between nodes prior to the start of transmission.

Communications Computer - A computer that acts as the interface between another computer or a terminal and a communications link.

Decentralized Network - A distributed network of centralized sub-networks.

Distributed Network - A network in which the majority of nodes are not directly connected to a majority of the other nodes.

Front-end Computer - See Communications Computer.

Host Computer - A network computer acting as a service node.

Link - A communications path between two nodes.

Network-

1) An interconnected or interrelated group of nodes;

2) In connection with a disciplinary or problem oriented qualifier, the combination of material, documentation and human resources that are united by design to achieve certain objectives. (E.g., a science information network).

Node - A point of convergence of communication paths in a network.

Process - A systematic sequence of operations to produce a specified result.

Protocol - A formal set of conventions governing the format and relative timing of message exchange between two communicating processes.

Regional Network - A network whose nodes are confined to a specified geographical area.

Remote Job Entry - The mode of operation that allows input of a batch job by a card reader at a remote site and receipt of output by a line printer or card punch at the remote site.

Resource - Any capability or service available to users, such as computational power, brain power, programs, data files, storage capacity, or a combination of these.

Resource Sharing - The joint use of resources on a network by a number of dispersed users.

RJE - see Remote Job entry.

Server Node - A node primarily providing network resources.

Store and Forward - Pertaining to communications where a message is received, stored until ready for output, and then retransmitted.

Tariff - Communications tariffs are schedules filed by common carriers that specify the classifications and charges for offered facilities or types of service. Under the Communications Act of 1934, interstate and international tariffs are approved by the Federal Communications Commission.

Terminal - A point in a system or communication network at which data can enter or exit.

18521 Distribution
Jean Iseli,

What I've been up to lately

(J18521) 21-AUG-73 07:39; Title: Author(s): Ira W. Cotton/IWC;
Distribution: /JI; Sub-Collections: NIC; Clerk: IWC;
Origin: <NBS-TIP>NSF-COTTON.NLS;3, 17-AUG-73 13:48 IWC ;2, 18-JUN-73
15:12 IWC ;

NJN 21-AUG-73 08:18 18522

NLS command language changes

The spec for the new command language looks very good on the whole. I'm glad that the language will now be better organized and more cohesive. That will make it much easier for new users to learn. 1

Old users may have some problem getting adjusted as you know well. If it is possible, maybe you could phase in the changes over a period of time so we could learn them gradually rather than being faced with a new language at one specific date. It is the change in command names and in recognition modes that will cause the most problems I suspect, so if those parts could be phased in some way, it would be helpful. 1a

Other than these general comments I have just a few specific questions: 2

1. Special characters INSERT and REPEAT. 2a

Why do you need both of these keys? You acknowledged that there was some inconsistency between insert commands and other editing commands that the system presumably recognizes. Wy can't it recognize the differences when a REPEAT key is used? Having one standard REPEAT key would simplify things for the user. 2a1

Connect Display (or TTY) and Connect to file directory 2b

These commands are confusing. Since they perform quite different functions I believe they should have different names. I realize you can't use Link for the terminal hookups, but some name other than connect should be possible. 2b1

Insert JOurnal submission, Directory, Archived directory 2c

What do these commands do? 2c1

Recognition modes 2d

In the different modes, who types the space between command words? Is it the user or the system, and does it vary with the recognition mode? 2d1

An error in the Summary of NLS Commands (userguides, commands,): 3

jump to origin, end, head and tail should not have an optional [number] in front of them. 3a

That's about all. Good luck with your implementation. --Nancy 4

18522 Distribution
Charles H. Irby, N. Dean Meyer, Charles F. Dornbush,

NLS command language changes

(J18522) 21-AUG-73 08:18; Title: Author(s): Nancy J. Neigus/NJN;
Distribution: /CHI NDM CFD; Sub-Collections: NIC; Clerk: NJN;

EJK 21-AUG-73 08:43 18523

link to mbs info

these are some notes i made on the mission analysis for base communications. might be interesting in relation to sadpr study.

link to mbs info

EJK 16-AUG-73 14:08 18479
notes on ma for base comm
Location: (MJOURNAL, 18479, 1:w)
*****Note: Author Copy*****

18523 Distribution
Edmund J. Kennedy,

link to mbs info

(J18523) 21-AUG-73 08:43; Title: thx"; Author(s): Edmund J. Kennedy/EJK; Distribution: /EJK; Sub-Collections: RADC; Clerk: EJK;

JDH 21-AUG-73 08:53 18524

Re 18517--Standardizing Network Mail Headers

Your Network Mail Header format looks fine. One of the modifications to Journal delivery will be to make it drop out separate files for separate items going to a particular user instead of a single file as it does now. 1

18524 Distribution
James E. (Jim) White,

JDH 21-AUG-73 08:53 18524

Re 18517--Standardizing Network Mail Headers

(J18524) 21-AUG-73 08:53; Title: Author(s): J. D. Hopper/JDH;
Distribution: /JEW; Sub-Collections: SRI-ARC; Clerk: JDH;

More Recognizable Acronyms Would Make Syntax Easier to Follow

DIRT has adopted a working description of the user we address: An intelleggent, technically naive secretary (Jeannie Leavitte would be a fair example). 1

I believe someome of the acronyms in the proposed command language syntax will defeat such users, or indeed most users, faster than they will educate them. 2

When we present to them constructions like SSEL and DSEL we are asking them to learn an extra layer of defintions which they will have to translate conciously every time they resort to the syntax, like reading in a foreign language with a dictionary. 3

I would like to see ADDRESS replace LSEL, SSEL, and DSEL. The prompts (noise words) could make clear which applies. They should anywway. 4

Similarlly I thinK LEVEL would make more sense to outsiders than LEVADJ. 4a

Similarlly I would like to se TOWHERE reduced to WHERE, with the prompts supplying the difference. 4b

Finally there is a special tangle around the word "text" which is used in our terminology to mean several different things. The general meaning of the words "text" and "entity" compound the problem. "Text" does not imply shortness, one may speak of the text of the dictionary. "Entity" is very abstract and general, hence functons poorly to restrict the meaning of words that it may be attached to. 5

I suggest: 5a

We replace TEXT-ENTITY with CHARACTERS; 5a1

Then we can replace STRUCTURE-ENTITY with STRUCTURE. 5a2

This arrangement frees "text" to mean the addressable part of a statement, brother to "visisble", "word", etc. 5a3

At the same time we can replace "text" in the sense of lit with "Content", and the prompt "T:" with "C:". 5a4

This content is the stuff the content analyser searches, so we won't get into trouble with a conflict in terms there. 5a4a

The syntax for replace would then read: 6

Replace CHARACTERS (at) ADDRESS (by) [CHARACTERS] CONTENTS CONFIRM
STRUCTURE [STRUCTRE] 6a

18526 Distribution

Elizabeth J. (Jake) Feinler, Harvey G. Lehtman, Kirk E. Kelley, Laura E. Gould, N. Dean Meyer, Jeanne M. Beck, Charles F. Dornbush, Dirk H. Van Nouhuys, Michael D. Kudlick, Diane S. Kaye, James C. Norton, Charles H. Irby, James C. Norton, Richard W. Watson, Michael D. Kudlick,

More Recognizable Acronyms Would Make Syntax Easier to Follow

(J18526) 21-AUG-73 09:55; Title: Author(s): Dirk H. Van Nouhuys/DVN;
Distribution: /DIRT CHI JCN RWW MDK; Sub-Collections: SRI-ARC DIRT;
Clerk: DVN;
Origin: <VANNOUHUYS>MYLIN.NLS;2, 21-AUG-73 09:48 DVN ;

MLK 21-AUG-73 12:48 18527

Duplications in your Mail

Will, Jim White checked the duplication of net mail problem you had. What happened is as follows: both you and the principal investigator at your site have the same network mailbox; that's LINCOLN at BBN-TENEX in the identfile. The dupication was because allthree items (the ones you sent copies of) were sent to both WK (liaison) and JWF (Principal Investigator. Since you both have the same mailbox address, then of course there would be two copies delivered to the mailbox. So, as Jim said, all is as it should be. Marcia. 1

18527 Distribution
William Kantrowitz,

Duplications in your Mail

(J18527) 21-AUG-73 12:48; Title: Author(s): Marcia Lynn Keeney/MLK;
Distribution: /WK; Sub-Collections: SRI-ARC; Clerk: MLK;

JEW 21-AUG-73 13:39 18528

Response to Comments About Network Mail Headers

Copies to RST, AKB, KP, and JDH.

JEW 21-AUG-73 13:39 18528

Response to Comments About Network Mail Headers

Concerning your comments, Ken:

(1) It reads: "One fairly serious result of this lack of..."
(2) You're right: <mailtext> ::= <header> <CRLF> <message>
(3) I added the extra space before time for readability.
(4) The hyphen before time zone helps TENEX.
(5) I THOUGHT we agreed on the 24 JUL 1973 format. I favor it.
(6) How about allowing ANY keyword to be either all upper- or all lower-case characters?

Also:

(1) The hyphen before time zone is missing from the example by mistake.

1

18528 Distribution
Ray S. Tomlinson, Kenneth T. Pogran, Abhay K. Bhushan, J. D. Hopper,

Response to Comments About Network Mail Headers

(J18528) 21-AUG-73 13:39; Title: Author(s): James E. (Jim) White/JEW; Distribution: /RST KP AKB JDH; Sub-Collections: SRI-ARC KP; Clerk: JEW;

August 5-11, 1973: A WEEK IN REVIEW

WEEKLY ANALYSIS REPORT:

WEEK: AUG 5 - 11, 1973 (24 HOURS/DAY)

TOTAL SYSTEM CPU: 66.504

(ARC)

IDENT	CPU HRS	CON HRS	CPU/CON	% SYS	CON/CPU:1
(STAFF)					
(JMB)	.705	17.162	.041	1.060	24.343
(DCE)	-	-	-	-	-
(SRL)	.271	10.265	.026	.407	37.878
(NDM)	-	-	-	-	-
(JCN)	1.221	35.206	.035	1.836	28.834
(DVN)	.882	16.990	.052	1.326	19.263
(PR)	.169	5.879	.029	.254	34.787
(RWW)	.167	3.554	.047	.251	21.281
	-----	-----		-----	
(TOTAL)	3.415	89.056		5.134	
(PSO)					
(JML)	.023	2.231	.010	.035	97.000
(BAH)	.501	20.014	.025	.753	39.948
(MEJ)	4.204	104.578	.040	6.321	24.876

(KIRK)	1.378	28.456	.048	2.072	20.650	6a4d
	-----	-----		-----		6a4e
(TOTAL)	6.106	155.279		9.181		6a4f
						6a4g
(NIC)						6a5
(JDC)	.073	3.070	.024	.110	42.055	6a5a
(EJF)	.249	8.358	.030	.374	33.566	6a5b
(CBG)	.003	.081	.037	.005	27.000	6a5c
(MDK)	.002	.098	.020	.003	49.000	6a5d
(MLK)	.511	22.364	.023	.768	43.765	6a5e
(JBN)	.768	26.404	.029	1.155	34.380	6a5f
	-----	-----		-----		6a5g
(TOTAL)	1.606	60.375		2.415		6a5h
						6a5i
(HARDWARE)						6a6
(MEH)	.010	.486	.021	.015	48.600	6a6a
(JR)	-	-	-	-	-	6a6b
(EKV)	-	-	-	-	-	6a6c
	-----	-----		-----		6a6d
(TOTAL)	.010	.486		.015		6a6e
						6a6f
(TENEX)						6a7
(DIA)	6.349	69.831	.091	9.547	10.999	6a7a
(WRF)	.149	10.872	.014	.224	72.966	6a7b
(KEV)	.643	19.111	.034	.967	29.722	6a7c

(DCW)	.944	24.240	.039	1.419	25.678	6a7d
	-----	-----		-----		6a7e
(TOTAL)	8.085	124.054		12.157		6a7f
						6a7g
(NLS)						6a8
(CFD)	.945	33.975	.028	1.421	35.952	6a8a
(JDH)	.523	23.043	.023	.786	44.059	6a8b
(CHI)	.003	1.591	.002	.005	530.333	6a8c
(DSK)	.826	21.592	.038	1.242	26.140	6a8d
(HGL)	.404	9.107	.044	.607	22.542	6a8e
(EKM)	.233	9.247	.025	.350	39.687	6a8f
(JEW)	1.063	29.283	.036	1.598	27.548	6a8g
	-----	-----		-----		6a8h
(TOTAL)	3.997	127.838		6.009		6a8i
						6a8j

(GROUP) TOTALS 6b

GROUP	CPU HRS	CON HRS	CPU/CON	% SYS	CON/CPU	
						6b2
(STAFF)	3.415	89.056	.038	5.135	26.078	6b3
(PSO)	6.106	155.279	.039	9.181	25.431	6b4
(NIC)	1.606	60.375	.027	2.415	37.593	6b5
(HARDWARE)	.010	.486	.021	.015	48.600	6b6
(TENEX)	8.085	124.054	.065	12.157	15.344	6b7
(NLS)	3.997	127.838	.031	6.010	31.983	6b8
	-----	------		-----		6b9

(TOT)	23.219	557.088		34.913		6b10
						6b11
(STATS)						6c
HIGHEST CPU:	DIA	6.349 hrs	LOWEST CPU:	MDK	.002 hrs	6c1
HIGHEST CON:	MEJ	104.578 hrs	LOWEST CON:	CBG	.081 hrs	6c2
HIGHEST CPU/CON:	DIA	.091	HIGHEST CON/CPU:1:	CHI	530.333	6c3
						6c4
(OVERHEAD)						6d
(JCP)	1.933	68.149	.028	2.907	35.256	6d1
BACKGROUND	3.084	133.615	.023	4.637	43.325	6d2
CAT	5.987	48.815	.123	9.002	8.153	6d3
DOCB	-	-	-	-	-	6d4
DOCUMENTATION	1.063	6.380	.167	1.598	6.002	6d5
GILBERT	-	-	-	-	-	6d6
NETINFO	.172	5.519	.031	.259	32.087	6d7
NIC-WORK	-	-	-	-	-	6d8
OPERATOR	1.709	14.064	.122	2.570	8.229	6d9
PRINTER	6.307	133.614	.047	9.484	21.185	6d10
SYSTEM	14.130	408.074	.035	21.247	28.880	6d11
	-----	-----		-----		6d12
(TOTAL)	34.385	818.230		51.704		6d13
						6d14
(XEROX)						6e
						6e1
NAME	CPU HRS	CON HRS	CPU/CON	% SYS	CON/CPU:1	6e2

(LPD)DEUTSCH	.073	3.892	.019	.110	53.315	
(CMG)GESCHKE	-	-	-	-	-	
(JGM)MITCHELL	.258	37.089	.007	.388	143.756	
(WHP)PAXTON	-	-	-	-	-	
(EHS)SAT-WTE	.224	8.895	.025	.337	39.710	
(RES)SWEET	.165	8.943	.018	.248	54.200	
	-----	-----		-----		
(TOTAL)	.720	58.819		1.083		

(RADC)

NAME	CPU HRS	CON HRS	CPU/CON	% SYS	CON/CPU:1	DIR
BAIR	.237	11.005	.022	.356	46.435	-
BERGSTRM	.004	.130	.031	.006	32.500	-
BETHKE	.059	4.758	.012	.089	80.644	-
CAVANO	.746	6.294	.119	1.122	8.437	-
IUORNO	-	-	-	-	-	-
KENNEDY	.224	12.743	.018	.337	56.888	-
LAMONICA	.216	4.291	.050	.325	19.866	-
LAWRENCE	.051	2.625	.019	.077	51.471	-
MCNAMARA	.116	6.042	.019	.174	52.086	-
PANARA	.028	1.653	.017	.042	59.036	-
RADC	.009	.676	.013	.014	75.111	-

RZEPKA	.028	1.763	.016	.042	62.964	-	6f15
SLIWA	.019	.743	.026	.029	39.105	-	6f16
STONE	.334	36.153	.009	.502	108.243	-	6f17
THAYER	.006	.585	.010	.009	97.500	-	6f18
TOMAINI	.120	11.011	.011	.180	91.758	-	6f19
	-----	-----		-----		-----	6f20
(TOTAL)	2.197	100.472		3.304		-	6f21
(PER CENT TOTAL DISK CAPACITY)						-	6f22
							6f23

(NETUSERS) TOP FIVE 6g

6g1

NAME	CPU HRS	CON HRS	CPU/CON	% SYS	CON/CPU:1	
						6g2
						6g3
UCSB	1.288	24.606	.052	1.937	19.104	6g4
HELP	.548	37.119	.015	.824	67.735	6g5
GUEST	.547	21.202	.026	.823	38.761	6g6
NBS-TIP	.486	19.417	.025	.731	39.953	6g7
MITRE-TIP	.376	16.344	.023	.565	43.468	6g8
	-----	-----		-----		6g9
(TOTAL)	3.245	118.688		4.880		6g10
						6g11

(NET) TOTAL	CPU HRS	CON HRS	CPU/CON	% SYS	CON/CPU:1	
						6h
						6h1
NET	5.516	238.970	.023	8.294	43.323	6h2
						6h3

August 5-11, 1973: A WEEK IN REVIEW

(OTHER)	CPU HRS	CON HRS	CPU/CON	% SYS	CON/CPU:1
ENERGY	.022	1.066	.021	.033	48.455

18529 Distribution

Susan R. Lee, Beauregard A. Hardeman, Douglas C. Engelbart, Don I. Andrews, Marilyn F. Auerbach, Walt Bass, Charles F. Dornbush, Elizabeth J. (Jake) Feinler, Martin E. Hardy, J. D. Hopper, Charles H. Irby, Mil E. Jernigan, Diane S. Kaye, Kirk E. Kelley, Michael D. Kudlick, Elizabeth K. Michael, Jeanne B. North, James C. Norton, Jeffrey C. Peters, Paul Rech, Dirk H. Van Nouhuys, Kenneth E. (Ken) Victor, Donald C. (Smokey) Wallace, Richard W. Watson, James E. (Jim) White, Duane L. Stone, Thomas F. Lawrence, James H. Bair, L. Peter Deutsch, James G. Mitchell,

August 5-11, 1973: A WEEK IN REVIEW

(J18529) 21-AUG-73 14:25; Title: Author(s): Beauregard A. Hardeman/BAH; Distribution: /WAR; Sub-Collections: SRI-ARC WAR; Clerk: BAH;

August 12-18, 1973: A WEEK IN REVIEW

WEEKLY ANALYSIS REPORT:

WEEK: AUG 12 - 18, 1973 (24 HOURS/DAY)

TOTAL SYSTEM CPU: 55.396

(ARC)

IDENT	CPU HRS	CON HRS	CPU/CON	% SYS	CON/CPU:1
(STAFF)					
(JMB)	.848	25.859	.033	1.531	30.494
(DCE)	.210	7.861	.027	.379	37.433
(SRL)	.150	3.769	.040	.271	25.127
(NDM)	.678	18.218	.037	1.224	26.870
(JCN)	.640	10.852	.059	1.155	16.956
(DVN)	2.050	31.783	.064	3.701	15.504
(PR)	.013	.650	.020	.023	50.000
(RWW)	.161	6.155	.026	.291	38.230
	-----	-----		-----	
(TOTAL)	4.750	105.147		8.575	
(PSO)					
(JML)	.076	6.285	.012	.137	82.697
(BAH)	.716	25.373	.028	1.293	35.437
(MEJ)	2.089	82.739	.025	3.771	39.607

(KIRK)	.317	5.342	.059	.572	16.852	6a4d
	-----	-----		-----		6a4e
(TOTAL)	3.198	119.739		5.773		6a4f
						6a4g
(NIC)						6a5
(JDC)	.018	1.093	.016	.032	60.722	6a5a
(EJF)	-	-	-	-	-	6a5b
(CBG)	.014	.876	.016	.025	62.571	6a5c
(MDK)	-	-	-	-	-	6a5d
(MLK)	.509	25.307	.020	.919	49.719	6a5e
(JBN)	.596	30.448	.020	1.076	51.087	6a5f
	-----	-----		-----		6a5g
(TOTAL)	1.137	57.724		2.052		6a5h
						6a5i
(HARDWARE)						6a6
(MEH)	.083	2.338	.036	.150	28.169	6a6a
(JR)	-	-	-	-	-	6a6b
(EKV)	-	-	-	-	-	6a6c
	-----	-----		-----		6a6d
(TOTAL)	.083	2.338		.150		6a6e
						6a6f
(TENEX)						6a7
(DIA)	1.987	27.963	.071	3.587	14.073	6a7a
(WRF)	.261	12.425	.021	.471	47.605	6a7b
(KEV)	1.663	29.361	.057	3.002	17.655	6a7c

(DCW)	1.056	22.964	.046	1.906	21.746	6a7d
	-----	-----		-----		6a7e
(TOTAL)	4.967	92.713		8.966		6a7f
						6a7g
(NLS)						6a8
(CFD)	.956	29.625	.032	1.726	30.988	6a8a
(JDH)	.080	3.911	.020	.144	48.888	6a8b
(CHI)	.139	8.670	.016	.251	62.374	6a8c
(DSK)	.254	8.125	.031	.459	31.988	6a8d
(HGL)	.618	16.600	.037	1.116	26.861	6a8e
(EKM)	.055	4.804	.011	.099	87.345	6a8f
(JEW)	1.063	34.950	.030	1.919	32.879	6a8g
	-----	-----		-----		6a8h
(TOTAL)	3.165	106.685		5.714		6a8i
						6a8j

(GROUP) TOTALS 6b

GROUP	CPU HRS	CON HRS	CPU/CON	% SYS	CON/CPU	
						6b2
(STAFF)	4.750	105.147	.045	8.575	22.136	6b3
(PSO)	3.198	119.739	.027	5.773	37.442	6b4
(NIC)	1.137	57.724	.020	2.052	50.769	6b5
(HARDWARE)	.083	2.338	.036	.150	28.169	6b6
(TENEX)	4.967	92.713	.054	8.966	18.666	6b7
(NLS)	3.165	106.685	.030	5.713	33.708	6b8
	-----	------		-----		6b9

(TOT)	17.300	484.346		31.229		6b10
						6b11
(STATS)						6c
HIGHEST CPU:	MEJ 2.089 hrs		LOWEST CPU:	PR .013 hrs		6c1
HIGHEST CON:	MEJ 82.739 hrs		LOWEST CON:	PR .650 hrs		6c2
HIGHEST CPU/CON:	DIA .071		HIGHEST CON/CPU:1:	EKM 87.345		6c3
						6c4
(OVERHEAD)						6d
(JCP)	1.909	72.144	.026	3.446	37.792	6d1
BACKGROUND	1.950	117.647	.017	3.520	60.332	6d2
CAT	7.909	17.272	.458	14.277	2.184	6d3
DOCB	-	-	-	-	-	6d4
DOCUMENTATION	.334	8.856	.038	.603	26.515	6d5
GILBERT	-	-	-	-	-	6d6
NETINFO	-	-	-	-	-	6d7
NIC-WORK	-	-	-	-	-	6d8
OPERATOR	1.601	12.129	.132	2.890	7.576	6d9
PRINTER	4.392	117.650	.037	7.928	26.787	6d10
SYSTEM	11.699	372.188	.031	21.119	31.814	6d11
	-----	-----		-----		6d12
(TOTAL)	29.794	717.886		53.783		6d13
						6d14
(XEROX)						6e
						6e1
NAME	CPU HRS	CON HRS	CPU/CON	% SYS	CON/CPU:1	6e2

(LPD)DEUTSCH	.030	.440	.068	.054	14.667	6e4
(CMG)GESCHKE	.001	.008	.125	.002	8.000	6e5
(JGM)MITCHELL	.324	14.578	.022	.585	44.994	6e6
(WHP)PAXTON	-	-	-	-	-	6e7
(EHS)SAT-WTE	.274	8.003	.034	.495	29.208	6e8
(RES)SWEET	-	-	-	-	-	6e9
	-----	-----		-----		6e10
(TOTAL)	.629	23.029		1.136		6e11

6e3 6e12

(RADC) 6f

6f1

NAME	CPU HRS	CON HRS	CPU/CON	% SYS	CON/CPU:1	DIR	
							6f3
BAIR	.420	43.498	.010	.758	103.567	231	6f4
BERGSTRM	.072	12.242	.006	.130	170.028	40	6f5
BETHKE	.118	4.217	.028	.213	35.737	88	6f6
CAVANO	.097	6.050	.016	.175	62.371	102	6f7
IUORNO	.001	.030	.033	.002	30.000	27	6f8
KENNEDY	.168	30.324	.006	.303	180.500	48	6f9
LAMONICA	.502	9.691	.052	.906	19.305	59	6f10
LAWRENCE	.076	4.069	.019	.137	53.539	45	6f11
MCNAMARA	.059	4.189	.014	.107	71.000	114	6f12
PANARA	.056	2.863	.020	.101	51.125	89	6f13
RADC	.008	.125	.064	.014	15.625	47	6f14

RZEPKA	-	-	-	-	-	32
SLIWA	.002	.056	.036	.004	28.000	20
STONE	.714	21.807	.033	1.289	30.542	212
THAYER	-	-	-	-	-	37
TOMAINI	.008	.158	.051	.014	19.750	45
	-----	-----		-----		-----
(TOTAL)	2.301	139.319		4.153		1236.000
(PER CENT TOTAL DISK CAPACITY)						2.538%

(NETUSERS) TOP FIVE

NAME	CPU HRS	CON HRS	CPU/CON	% SYS	CON/CPU:1
HELP	.589	28.226	.021	1.063	47.922
MITRE-TIP	.416	17.709	.023	.751	42.570
UCSB	.379	7.798	.049	.684	20.575
UCLA-NMC	.324	12.681	.026	.585	39.139
NBS-TIP	.321	10.841	.030	.579	33.773
	-----	-----		-----	
(TOTAL)	2.029	77.255		3.662	

(NET) TOTAL

	CPU HRS	CON HRS	CPU/CON	% SYS	CON/CPU:1
NET	5.217	267.089	.020	9.418	51.196

(OTHER)	CPU HRS	CON HRS	CPU/CON	% SYS	CON/CPU:1	6i
						6i1
ENERGY	-	-	-	-	-	6i2
						6i3
						7

18530 Distribution

Susan R. Lee, Beauregard A. Hardeman, Douglas C. Engelbart, Don I. Andrews, Marilyn F. Auerbach, Walt Bass, Charles F. Dornbush, Elizabeth J. (Jake) Feinler, Martin E. Hardy, J. D. Hopper, Charles H. Irby, Mil E. Jernigan, Diane S. Kaye, Kirk E. Kelley, Michael D. Kudlick, Elizabeth K. Michael, Jeanne B. North, James C. Norton, Jeffrey C. Peters, Paul Rech, Dirk H. Van Nouhuys, Kenneth E. (Ken) Victor, Donald C. (Smokey) Wallace, Richard W. Watson, James E. (Jim) White, Duane L. Stone, Thomas F. Lawrence, James H. Bair, L. Peter Deutsch, James G. Mitchell,

August 12-18, 1973: A WEEK IN REVIEW

(J18530) 21-AUG-73 15:27; Title: Author(s): Beauregard A. Hardeman/BAH; Distribution: /WAR; Sub-Collections: SRI-ARC WAR; Clerk: BAH;

RMS 22-AUG-73 10:18 18531

MAILBOX ADDRESS

DAVE---
MY NETWORK MAILBOX ADDRESS IS 'SROUGHTN@UCSB'. YOU CAN ALSO CONSULT THE NIC IDENT SYSTEM TO DETERMINE THE MAILBOX ADDRESS OF ANY OTHER UCSB PERSONNEL IF YOU HAPPEN TO KNOW THEIR NIC IDENT. HOW ARE THINGS THESE DAYS? WHEN DO YOU GET YOUR ANTS SYSTEM? ---RON 1

18531 Distribution
David H. Crocker;

MAILBOX ADDRESS

(J18531) 22-AUG-73 10:18; Title: Author(s): Ronald M. Stoughton/RMS; Distribution: /DHC; Sub-Collections: NIC; Clerk: RMS;

DVN 21-AUG-73 16:43 18532

First Cut at Organizing London TNLS COURSE

I have organized the flip charts as shown below. We should look at them together and consider how you want to use them. In addtion I reccomend the following aids:
The Q-card.
The Primer <userguides,primer,>
XED <jjournal,17352,> 1

-- DAY #1 --

2

INTRODUCTION 2a

ARC BACKGROUND 2a1

NIC - FUNCTIONS & FACILITIES 2a2

GENERAL CHARACTERISTICS OF NLS 2a3

"CLASS PROFILE" 2a4

Ask the students to identify themselves and what they hope for from the class. 2a4a

SOME GOALS WE CAN SET FOR THIS CLASS 2a5

SENDING A SIMPLE JOURNAL MESSAGE 2b

TENEX OVERVIEW 2c

TENEX vs NLS COMMANDS 2c1

LINKING AND SYSTAT 2c2

FILE DIRECTORIES 2c3

ARCHIVING 2c4

SENDMESSAGE 2c5

NLS INTRODUCTORY CONCEPTS 2d

CREATING & PRINTING TEXT 2d1

Insert, Delete, Print, Substitute 2d1a

FILE LOADING, UPDATE 2d2

LOCATION, HOW TO FIND AND MOVE THE CONTROL MARKER 2d3

First Cut at Organizing London TNLS COURSE

-- DAY #2 --

First Cut at Organizing London TNLS COURSE

-- DAY #3 --

18532 Distribution
Douglas C. Engelbart,

First Cut at Organizing London TNLS COURSE

(J18532) 21-AUG-73 16:43; Title: Author(s): Dirk H. Van Nouhuys/DVN;
Distribution: /DCE; Sub-Collections: SRI-ARC; Clerk: DVN;
Origin: <DOCUMENTATION>DCEOUT.NLS;1, 21-AUG-73 16:41 DVN ;

My online address is KELLEY at SRI-ARC 1

18533 Distribution
David H. Crocker,

(J18533) 21-AUG-73 22:51; Title: Author(s): Kirk E. Kelley/KIRK;
Distribution: /DHC; Sub-Collections: SRI-ARC; Clerk: KIRK;

Some Thoughts on the NIC and the Use of SDI 1

INTRODUCTION 2

After doing some reading about information centers and services, some questions have come to mind about the direction in which the NIC is moving. In particular, the practice of selective dissemination of information (SDI) seems to be one of the newer means for coping with a large bulk of information. For this reason, consideration should be given to whether some program of SDI would be of benefit to the network. 2a

CHARACTERISTIC SDI SITUATION 3

The circumstances resulting in the institution of a program of SDI are typically: 3a

1) a large group of people with some common interest, usually of a general nature, such as chemistry or physics, and 3a1

2) a volume of published information which is needed by these people, but which would be difficult if not impossible to keep track of. 3a2

In our context, a similar group of people would be the energy community, the VELA community or some other such group. 3a3

CURRENT NIC MODIFIED SDI SERVICES 4

There are currently two activities under way as a part of the NIC service which could be classified as modified attempts at SDI. 4a

1) At some sites the transmittal letters listing the latest RFC's are distributed to a number of people who check to see if anything of interest to them has been distributed. Although everyone on the network receives an identical list, the concept is still that of SDI. 4a1

That is, at some point, someone has determined that the people composing the network have some common interest, and again that some document will be of interest to a good number of these people. The NIC duly distributes it. Then, if the station agent distributes the list of documents, the individual can choose whether or not to read it. 4a2

In its true sense, SDI first entails determining the interests of each person, and distributing a list of just those documents which fit his interests. 4a3

2) The other modified instance of SDI occurs with the special group concept. 4a4

In this case, a highly specialized topic of interest is isolated and any paper submitted by a member is distributed to the entire group. 4a5

The reason for this unselective mode of dissemination may be that the interest is so well-defined (as opposed to chemistry) that all papers are of interest to all group members. 4a6

FUTURE POSSIBILITIES FOR EXISTING SERVICES 5

Network 5a

The mechanism already exists for a modified SDI as described in (1) above. Implementation would involve encouraging distribution of the transmittal letters and other lists of documents available as a modified form of SDI. Issuing a bulletin of recently acquired documents, such as was previously done, is another attempt along these lines. However, the subjects to be included in the bulletin need to be specified. 5a1

It seems that these are worthwhile attempts to relieve some of the information burden from the network researchers and should be considered from the viewpoint of the function they perform, which in this case appears to be mainly awareness. 5a2

Groups 5b

It is my feeling that many of the groups are currently too small and defined on the basis of too specific an interest to benefit from SDI. A possible exception would be the Computer Based Instruction (CBI) Group. 5b1

THE QUESTION OF GOALS 6

A problem I see is that the goals of the NIC are not clearly defined. This becomes a problem when one attempts to determine what areas merit further development or elimination, as in the recent evaluation of the NIC or when a modification to services such as SDI is considered. 6a

In Larry Roberts' paper presented at the 1970 Spring Joint Computer Conference, the function of the NIC was described as follows: 6b

> The NIC is being established at SRI as the repository of information about all systems connected into the network. The

NIC will maintain, update and distribute hard copy information to all users. It will also provide file space and a system for accessing and updating (through the net) dynamic information about the systems, such as system modifications, new resources available, etc. 6b1

In the latest proposal, the NIC concept was completely reconsidered, however, the statements concerning needs and goals were not specific (probably for good reason). 6c

For example, two needs stated were a need for a reference service providing "consumer information" and a need for well-structured information exchange mechanisms. However, the scope of the information to be handled needs to be defined before the type of reference service or exchange mechanism can be considered. 6c1

Also in this proposal is a discussion of the fact that the NIC is no longer able to give uniform service and that the service will have to be tailored to the individual's needs. Another problem stated is that of handling historic vs. recent information. 6c2

SDI is one possible means for handling such problems, but again, the problems need to be better defined before a statement can be made that SDI is part of the answer. 6c3

FUTURE POSSIBILITIES FOR THE NIC 7

From our current standpoint I can see three main directions in which the NIC can move. 7a

1) It can supply people with a means for communicating about current projects. The information transmitted would essentially be unpublished and distributed in hopes of soliciting comments from others on the network with similar interests. This is essentially the current operation with distribution of RFC's and group notes constituting the bulk of information. 7a1

2) In addition to the above, material could be collected from the various ARPANET sites in order to make the NIC truly "a repository of information about all systems connected into the network." This of course is a valid step to take only if the goal stated is still viable. 7a2

3) In addition to (1) or (2) or both, the NIC could actively work to collect and maintain collections of material written and published outside the ARPANET but on the subjects of

interest to the network community. I personally do not feel this is our responsibility or even a feasible possibility with our present means. 7a3

Under the current monetary restraints, it appears that the first alternative is most feasible, however, number two seems more in conjunction with the goals for the NIC as outlined in Roberts' paper. 7b

It appears to me that in the past an attempt has been made to accomplish the goals stated in all of the alternatives listed above. Although much effort has been expended, I do not think the NIC has been as successful as it might. 7c

One reason might be that the NIC is different from most other information centers in some very important ways, and thus not giving us the advantage of having a prototype to criticize and learn from. 7d

Differences that I see between the NIC and other information centers include: 7d1

1) Most information centers deal chiefly with material that is easily found in a library, the NIC does not. 7d1a

2) Largely because of this, the NIC deals in documents and not citations. 7d1b

3) Our subject areas of concentration are not nearly as well defined as most information centers, nor are our sources of information. 7d1c

4) The NIC currently uses a selective process of information dissemination for special groups only, and the selective process is determined solely by group membership (there is no selective dissemination within a group, possibly because the area of interest is so small). 7d1d

5) Information centers typically offer to conduct searches upon request (and for a cost). The NIC catalog, resource notebook and Query system allow the individual to do his own searching. Some centers do publish a catalog of sorts, but rarely does it encompass all information available as ours does. 7d1e

6) A loan service is also often available, and the NIC has no well-defined loan policy. 7d1f

These differences are sited so that comparisons between the NIC

and other information centers can be made in the proper framework. 7d2

FUTURE POSSIBILITIES FOR NIC SDI 8

If there is agreement that the NIC is not sufficiently meeting the goals it has set, then a program or modified program of SDI should probably at least be considered. 8a

I can see possibilities in the following areas: 8b

1) Encouragement of distribution of available lists of documents to other people located at a site who have an interest in the information distributed by NIC. 8b1

2) Consider a program of SDI, not as a service to all groups, but as an experiment with a group such as the CBI group. The purpose of such an experiment would be to attempt to find better ways of meeting the information needs of a group of people. According to their wishes, the information could come from a published source through referral by a group member or through some other means. 8b2

This could be a part of the ARPA-IPT Community Information Service (ACIS) development. 8b3

3) If the goal stated in Roberts' '70 SJCC paper is still viable, 8b4

> The NIC is being established at SRI as the repository of information about all systems connected into the network . . . 8b4a

then an attempt could be made to encourage more participation and use of the NIC for this purpose. 8b5

It is my opinion that much research and activity is taking place at various sites on the network that we hear very little about. People could be encouraged to contribute more information about their activities (possibly just selected activities on topics which a number of people are interested) and the information the NIC receives could be distributed to other sites or people on a selective basis. 8b6

The incoming information could be in many forms, possibly just a message indicating that a particular individual is working on a particular project. Of necessity the distribution would be of citations rather than documents and its purpose would be mainly to alert people to an activity and then let them be

responsible for following it up should their level of interest be high enough. 8b7

Either (2) or (3) above would be quite a project in terms of time and money. Therefore, these possibilities should be considered only in light of the overall goals of the NIC and any decision should reflect the judgement that making any such change would at least hope to improve the way in which we meet our goals. 8b8

18534 Distribution
Paul Rech, Michael D. Kudlick,

Some Thoughts on the NIC and SDI

(J18534) 22-AUG-73 08:37; Title: Author(s): Susan R. Lee/SRL;
Distribution: /PR(I am sending this to just you and Mike for now, if you think it needs wider distribution I'll do a secondary distribution.)
MDK; Sub-Collections: SRI-ARC; Clerk: SRL;
Origin: <LEE>SDI.NLS;7, 22-AUG-73 08:32 SRL ;

Proposal for Making and Using a HUMAN RESOURCES FILE for Energy Research

ARC 18588 J. B. North SRI Augmentation Research Center 28-AUG-73

SUMMARY OF THE PROPOSAL

Current interest in energy-related research makes it important to identify SRI people with energy-related backgrounds. Identification is difficult because the great interest in energy as a field of specialization is recent, and older resumes do not reflect a relationship to energy which now can be seen to exist. Many SRI staff members have expertise in fields which are related, but are not thus identified in their resumes or in the present SRI Skills Inventory.

To bring such information about SRI staff under control, a project has been suggested, a personnel inventory carried out for the purpose. Such an inventory, to result in a Human Resources File, is described here.

In considering the effort necessary to make any such inventory, it is useful to look at the possibility of getting additional benefit by designing the inventory and resultant file as prototypes for use with much larger populations.

The functions of identification, collection, input and retrieval are not essentially different for online and for manual files. Analysis of the needs and the design for the data base are applicable to building any inventory. At the point at which the information is to be stored, the two storage means, a manual file and a machine file are considered.

Construction and maintenance of either a manual or an online file is feasible. Decision between the two forms should be based on expectations for growth in size, scope, and use of the file. Clearly, an online file would be necessary to serve as a file prototype if the added aim of designing a prototype system were pursued.

A MANUAL file has certain obvious advantages: intrinsic low cost, machine independence, relative design simplicity.

Estimated cost for construction of a manual file of 200 names: 6 - 8 weeks of professional time; 2 - 3 weeks of clerical time.

Estimated monthly cost for maintenance of a manual file of 200 names: minimal (less than 2 hours professional time per week).

An ONLINE file is an attractive alternative, offering benefit in quick report generation, provision for formatted printed directories, economies in updating, and the possibility that related online files of resumes could be linked to it. Expansion to include other SRI or outside persons is more feasible with such a file than with a manual file.

Estimated cost for construction of a machine file of 200 - 500 names: 8 - 10 weeks professional time; 2 - 3 weeks clerical time.

Estimated monthly cost for maintenance of a machine file of 200 to 500 names: minimal (less than 2 hrs. per week).

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CONCLUSIONS:

An inventory of 200 to 500 people can be carried out, and an online or machine file built for information retrieval, together with a printed directory, for about $5000.

For a closed-end effort to locate and record not more than 200 SRI staff with energy-related backgrounds, a manual file is preferable.

For an open-end effort, to locate more than 200 staff, or to serve as a prototype inventory, an online file is preferable.

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1. INTRODUCTIO

a. The burgeoning interest in energy-related research has made it important to identify SRI people with energy-related backgrounds. Identification has been difficult because the general recognition of energy as a field of specialization is recent, and older resumes do not reflect a relationship to energy which now can be seen to exist. Many SRI staff members have expertise in fields which are related, but are not thus identified in their resumes or in the present SRI Skills Inventory.

b. To bring information about SRI staff under control, a project has been suggested, a personnel inventory carried out for the purpose.

c. Such an inventory, to result in a Human Resources File, is described here, and two means of building and maintaining the resultant file are described.

   A manual file has certain obvious advantages, and any alternative procedure adopted would need to be justified in cost and benefit terms.

   An online file is an attractive alternative, offering benefit in quick report generation, provision for formatted printed directories, economies in updating, and the possibility that related online files of resumes could be linked to it. Expansion to include other SRI or outside persons is more feasible with such a file than with a manual file.

d. Some of the procedures to be followed in building an inventory are as applicable to manual as to online files. The functions of identification, input and retrieval are not essentially different for online and for manual files. Therefore the analysis of the needs and the design for the data base are applicable to building any inventory. At the point at which the information is to be stored, the two storage means, a manual file and a machine file are considered.

e. Selection of a storage medium for a file would be made on the basis of the probability of its growth in size and with expectation of the evolving nature of its content. An online file of small size could serve as a prototype for a larger SRI inventory file, and eventually for an information-handling design to be sponsored by SRI for use by other organizations.

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2. ANALYSIS OF THE NEEDS

a. Information Needed About SRI People

The scope of the energy effort on a global scale indicates the range of expertise and knowledge which can be expected to be needed. The following broad subjects indicate the cross-disciplinary nature of the energy effort.

Energy resources	Energy consumption
Energy processing	Energy economics
Energy transportation	Energy geography
Energy technology	Energy politics
Energy marketing	

In relation to the above subjects, SRI staff can be expected to have applicable biographical information of the following types:

Subjects of education degrees and specializations

Industries in which they have worked

Particular organizations for which they have worked, or to which they have belonged

Levels of experience in work situations

Geographic areas in which education and work experiences occurred

Languages or cultures with which they are familiar

SRI Projects they have worked on

b. Estimated Number of SRI Staff to be Included in the File

It is important to realize that all such estimates are predicated on the definition of the term "energy-related". Estimates here are based on a definition which includes people working in processing, transportation, technology, geography, and so forth in ways which could be called on to contribute uniquely to energy problems, and which excludes people working in these fields or others whose contribution would be general rather than unique to energy.

Estimate 1. Clearly, the number of staff members now seen to be related to energy is larger than the present departments identified with this work. There are now about 45 professionals in the departments of energy economics and energy technology, and in energy efforts in operation evaluation areas. The presumption is that the specific capabilities of these people are to be identified, and that in addition at least an equal number of staff could be identified as having some of the same capabilities. Assuming the probable number of staff with energy-related expertise in peripheral areas might add another 50, the total would seem to be under 200.

Estimate 2. Another estimate can be made on the basis of the proportion of SRI people likely to be drawn into any one effort. It seems possible that the portion of SRI professionals to be engaged in energy efforts would be in proportion to the importance of the national research effort in this area. Federal obligation to energy R&D for 1974 exceeds $770 million in relation to a total Federal R&D budget of $5.5 billion; that is, about 14% of Federal R&D money is to be spent on energy. If SRI effort is in the same proportion, an estimated 100 SRI staff or full-time equivalence will be working on energy projects, and it seems likely the full-time equivalence will be spread over an additional 50 people, to make a total of perhaps 150.

Estimate 3. A quick analysis of the present Skills Inventory produced a list of 145 people under 100 terms judged to indicate some relation to energy research. (See Appendix A). It is known that the Skills Inventory lacks the names of many staff members. A second limitation is the difficulty in thinking of all the terms under which staff of interest might be entered. It is also true that the entries members select for themselves may suggest a relation greater than the actual contribution they could make to an energy program. An estimate which balances these factors might indicate a data base of 200.

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c. Usage to be Made of the Information

Frequency

The file would probably be heavily used for a few weeks after its initial formation, then frequency of use should taper off as the urgent questions of general identification of personnel are resolved. By the end of the first six months, it is estimated the file would be accessed for information about twice a week. The file would be updated about once a week by batching the new information.

Response Time Desired

Response time would be virtually immediate; the response time experienced by the questioner would depend on his mode of questioning, with either a manual or an online file.

Modes for a manual file:

Questioner uses a hardcopy Directory, produced frequently.

Questioner calls the File keeper and gets information verbally, perhaps followed by mailed photocopies.

Questioner visits the File and gets resume information in photocopy.

Modes which could be provided for an online file:

Questioner uses a terminal directly.

Experienced interrogator uses a terminal, in the presence of the requestor.

Experienced interrogator uses a terminal, transmitting the results by phone.

Experienced interrogator uses a terminal, transmitting printout of results by mail.

Using any of the above modes, copies of related resumes are supplied.

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d. Relation of the File to Other Sources of Information

The file to be produced could stand alone, but it is envisioned that it would work in conjunction with other files, the SRI Skills Inventory and a new biographical file created from the questionnaires circulated for the Human Resources File.

The present Skills Inventory could be used to cross-check for leads to relevant people. Also, all returned questionnaires could be duplicated for processing into the Skills Inventory if desired.

The present Skills Inventory file has limitations which make it difficult to use. Terms are truncated, and only staff names are given. No vocabulary control is exercised over the input, and there are no cross-references, which means that the retriever casts around for terms, and is likely to miss some. Entries under which one finds energy-related staff, for example, are:

```
ENERGY    (1 name)
   ENERGY-ACCOMMODATION    (1 name)
   ENERGY-CONSUMPTION    (1 name)
   ENERGY-CONVERSION    (1 name)
   ENERGY-PROPAGATION    (1 name)
   ENERGY-SUPPLY-AND-DE    (1 name)
   ENERGY-SYSTEMS    (1 name)
   also
   GEOTHERMAL-POWER-EXP    (1 name)
   POWER FROM OCEAN WAV    (1 name, not under ENERGY)
   SOLAR-ENERGY-CONVERS    (1 name, not under ENERGY)
   SOLAR-POWER-SYSTEMS    (1 name, not under ENERGY)
   WORLD-ENERGY    (1 name, not under ENERGY)
   and illustrating the retrieval difficulty
   COAL  etc.    (total of 10 names)
   FOSSIL-FUELS    (3 names, 1 also under COAL)
   OFFICE-OF-COAL-RESEARCH    (1 name, not under COAL)
   UTILIZATION-OF-COAL  (1 name, not under COAL)
```

The File has the capability of serving as an index to other files, either manual or online, such as files of resumes ready for use in proposals, and citation files of publications by SRI staff.

The returned questionnaires themselves would be filed, by personal name, in the room with the Human Resources File, so that reference could be made to them once names were retrieved from the HR File.

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e. Projected Costs and Benefits of the File

The costs associated with setting up and maintaining a file of about 200 people are itemizable and fairly predictable. The benefits, as is usually the case with information, are not so tangible.

Cost items, with estimates of their magnitude:

Item	Manual File	Online File
Questionnaire Preparation	130 hrs. prof. 40 hrs. cler. printing costs in both cases	130 hrs. prof. 40 hrs. cler.
Data Base Design	40 hrs. prof. 0 hrs. cler.	110 hrs. prof. 0 hrs. cler.
Data Base Construction	30 hrs. prof. 20 hrs. cler.	40 hrs. prof. 20 hrs. cler.
Initial Printed Directory	20 hrs. prof. 40 hrs. cler. printing costs in both cases	20 hrs. prof. 20 hrs. cler.
Scenario, Retrieval Guide	20 hrs. prof. 10 hrs. cler.	20 hrs. prof. 10 hrs. cler.
Updating, Weekly	<2 hrs. prof. <2 hrs. cler.	<2 hrs. prof. <2 hrs. cler.
Retrieval, on Demand	<2 hrs. prof. <2 hrs. cler.	<2 hrs. prof. <2 hrs. cler.
Est. Total	6 wks. prof. 4 wks. cler.	8 wks. prof. 3 wks. cler.

The certain benefit of construction of a file of some type is more thorough exploitation of SRI staff who have capabilities of use to energy programs. The value of this would be assessable only in relation to the results of SRI work in this very competitive field.

The relative merits of a manual and an online file are quite important in this case. While advantages are not as measurable as costs, they have substance.

Proposal for Making and Using a HUMAN RESOURCES FILE for Energy Research

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A manual file has the following features relative to a machine file.

It is machine independent; it cannot be rendered inoperable by system unavailability.

It is less difficult to design in that no provision has to be made for printed output.

It is intrinsically less expensive in that no computer cost is incurred.

A machine file has the following features relative to a manual file:

A machine file can, and would, be designed to generate reports; search output and periodic printed directories can be produced.

It can be accessed from a distance, with immediate printed results.

It can be linked to other online files, such as resume files, if desired.

For a file which is not expected to exceed 200 names and not intended to be linked to other online files, a manual file would be the apparent choice.

For a file which initially is to contain at least 200 names, and is planned to expand, particularly if the file is planned to allow expansion by links to other data bases such as online resume files, an online file has advantages.

An important factor is the possibility of using the file as a prototype for a similar file on a larger scale. Such a possibility would call for the institution of an online file.

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3. COLLECTING INFORMATION FOR THE FILE

a. Distribution of a Questionnaire

The present situation is that there are presumed to be many SRI staff members who have a contribution to make to some aspect of energy research, and that SRI would benefit from knowing who these people are now and at the times their contributions are needed.

A questionnaire could be distributed at the discretion of Energy Committee members to individuals or groups they judge to be likely candidates for a file on the energy-related human resources at SRI.

In a larger effort, a questionnaire could be distributed to all SRI professional staff, directly or through department heads, to gather all information which staff members can recognize as relevant.

Any questionnaire would be introduced by a letter from SRI management indicating the importance of the survey and asking cooperation.

b. Design of the Questionnaire

To get the best results, a questionnaire tailored to the subjects encompassed in the broad field of energy can be designed. The questionnaire would contain the usual fields for education and experience, and in addition, a controlled vocabulary to be checked off by the responder to indicate detailed capabilities. Only by structuring the data to be input can the retrieval of the data be predictable.

Thus the first activity would be the preparation of a vocabulary, followed by a structuring of the terms into a subject outline by which the responder would be led to give all relevant information. A study of the free input given on the Skills Inventory would insure incorporating the terms which SRI staff have attached to their own backgrounds. Study of current literature on energy would allow inclusion of current terms. Then the subject outline would correlate all of these.

A section of the questionnaire would request terms volunteered by the responder, particularly trade names and project names associated with their background.

It is assumed that final preparation of the questionnaire would be done by Reports Services.

The questionnaire would be formatted in such a way that the data could be read directly by the person keying the input into an online data base; no intermediate transcription would be necessary.

c. Editing the Questionnaire

Returned questionnaires would be examined to insure that the information supplied was of the nature expected, that there were no obvious mispellings, and the section of free input would be culled for relationships to standard terms, and the responder would be called to verify or to expand on the terms selected.

4. DESIGN FOR A MANUAL HUMAN RESOURCES FILE

a. Design of a Data Base

Using the outline of subjects designed for the questionnaire, the data base would consist of two parts, the returned questionnaires and a card index to them.

The questionnaires would be filed by member name.

A card index to them would be created, one card for each term, organization, language, etc., and names of staff who were identified with the terms would be entered on them. In addition to the names, the organization and present SRI assignment could be entered, with the understanding that these would get out of date unless a special effort were made to update them, there being no automatic way to do this in a manual system.

b. Entering Information Into the Data Base, the Human Resources File

From returned questionnaires, the names and possibly other information would be typed on term cards described above. These names would not be in any logical order on a card. Using the employee number rather than the name would create a false economy; time saved in entry would be consumed in retrieving unwanted resumes, AND SUCH A NUMBER SYSTEM IS MORE OPEN TO ERRORS WHICH COULD NOT BE TRACED.

Proposal for Making and Using a HUMAN RESOURCES FILE for Energy Research

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c. Making a Hardcopy Directory

A printed Directory could be produced, giving the name and department number of each staff member associated with a particular phase of energy work.

The phases of energy work as identified for the questionnaire would be cross-referenced to lead the seacher to terms selected.

Typing and proofing of the Directory would be time-consuming if the Directory were as much as 20 pages. Updating the Directory would be an entirely new effort, with no advantage from a previous issue.

d. Updating the Data Base

Capture of information on new SRI staff members who have energy-related skills may be made by periodic requests to department heads. Changes in background of present staff members would be pursued by periodic requests of respondents that they update their returns.There is no sure means of capturing all such information, and no sure means of keeping track of changes in background of present staff members. Awareness of the existence of the file would assist in this.

The actual input to update the data base would consist of marking out old entries on the term cards, and typing in new entries. If there is little activity, manual effort would be slight.

e. Accessing the File

Using the prepared guide to the vocabulary and the File, any searcher could access the printed Directory. The master card file would be accessed only by the person responsible for it. Names found and judged of interest would lead to the file of returned questionnaires, and conceivably to other hardcopy files of resumes.

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5. DESIGN FOR AN ONLINE HUMAN RESOURCES FILE

a. Design of an Online Data Base

The data base would be designed to be acted on by query programs which would retrieve and format the information for output on a TTY, and for output on a line printer. This would require some modification of existing programs to meet these new requirements.

The data base would also be designed for use with programs to produce a printed Directory, which may not be needed initially, but should be planned for.

Some design features would be:

Query capability, using terms from a printed thesaurus of terms used in input.

Boolean retrieval would be designed for, although the size of this data base probably would not warrant it; a simple comparison of the names retrieved under two or three headings would be adequate.

Retrieval of name and department of each staff member whose entry indicates his connection to the terms used in querying.

Department would be included because of the information context it provides; phone number would not be included, because it does not help in selection, and is otherwise available if calling is desired.

Output on a printed form on the ARC lineprinter, suitable for filing.

b. Entering Information Into the Data Base, the Human Resources File.

Returned questionnaires, after any necessary editing, would be keyed into the data base by conventions to be set in the design phase. The output would be proofed, and any indicated corrections would be made to the files and to the programs which manipulate them into the Directory.

c. Making a Hardcopy Directory

A printed Directory would be produced, giving the name and department number of each staff member associated with a particular phase of energy work.

The phases of energy work as identified for the questionnaire would be cross-referenced to lead the searcher to terms selected.

The hardcopy Directory would be updated as often as practicable in order to make it useful. If it appears that online querying is

the only practicable way to retrieve satisfactory results, that

is, if the file changes so rapidly that much useful information is not in the hardcopy, then the printed Directory would be abandoned. On the other hand, if changes are minimal, the hardcopy Directory might be issued more frequently, and hardcopy updates issued.

d. Updating the Data Base Online

Capture of information on new SRI staff members who have energy-related skills might be made by periodic requests to department heads. Changes in background of present staff members would be pursued by periodic requests of respondents that they update their returns. There is no sure means of capturing all such information, and no sure means of keeping track of changes in background of present staff members. AWareness of the existence of the file would assist in this.

Online updating of the file would consist of deleting, adding, or replacing information in one place in the file for each person added or with changed status.

e. Accessing the File Online, for Real-time Retrieval

The data base would be maintained online, for access by terminal in the ARC area. Access from a teletype terminal in a remote area could be arranged if desired. Requests for querying the file would be transmitted by phone or in person to an operator experienced not only in the use of the terminal, but more importantly, in the querying of the data base to extract all useful information from the data base.

Having the data base online might be more an investment in the future, when the data base would be many times larger and more detailed, than a necessity at this time. If so, online activity might be maintained at the lowest level which produces results.

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6. DATA ELEMENTS FOR A QUESTIONNAIRE

SRI Status

Name of Staff Member
ID Number
SRI Department
Present SRI Assignment
Date of Information

Education (Responder would give only the highest or most applicable degrees)

Bachelor Degree(s)	School	Date
Master Degree(s)	School	Date
Doctoral Degree(s)	School	Date
Other Degrees or Credits	School	Date

Employers

Employer's Name and Address Dates
Job Title
Type of Work

Relevant Professional Societies Membership

Language Capabilities

Languages Spoken
Languages Read
Languages Understood

Foreign Countries Resided in Dates

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General Occupational Field Total Years

Areas of Expertise

[Full page of vocabulary, as exemplified]

[Would include an introductory statement, indicating the thrust of the inquiry; SRI's needs, applicability of individual's experience]

[Would include instructions to check boxes in each section]

General

[] Energy Resources
[] Energy Transmission or Transportation
[] Energy Processing
[] Energy Technology
[] Energy Marketing
[] Energy Consumption
[] Energy Economics
[] Energy Geography
[] Energy Politics

Specific

[] Fuels, Specify.....
[]

SRI Projects Worked on

Project Name Dates

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7. SUBJECT GUIDE

With each hardcopy Directory, and also as a part of the Scenario for use of an online File, there would be an outline of the subject terms used in the file, for use in making searches.

Names of companies, schools, countries, would not be listed in this subject guide, because of the length of the lists, and because presumably no one such name would receive frequent use. Lists of such names would be generated from the file and would be available to the operator, to check against to assure standard input (e.g. IBM or International Business Machines) and as a guide to retrieval.

The Subject Guide would cover 2 or 3 pages, and would have a form similar to this:

GENERAL SUBJECTS

Economics
Planning
Biological Aspects see also Toxicology
Sociological Aspects
General Subject
General Subject
General Subject

SPECIFIC SUBJECTS

Fuels

Coal
Fossil Fuels (see Coal, Oil Fuels, Gasoline, Natural Gas)
Gas (see Natural Gas)

Electric Power

Specific Sub-subject
Specific Sub-subject see other Subject
Specific Sub-subject see other Sub-subject
Specific Sub-subject

Specific Subject

Specific Sub-subject
etc

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8. OUTLINE OF A SCENARIO FOR RETRIEVAL FROM AN ONLINE FILE

A scenario would be prepared to guide an operator to retrieve names by the single subject, and also by Boolean combinations. The scenario would cover the following processes:

Loading the File

Entering the Search Term or Statement

Printing the Result on the Terminal

Printing the Result on the Lineprinter

9. MOCKUP OF HARDCOPY OUTPUT FROM ONLINE FILE SEARCH

The result of a search of the Human Resources File would be printed at a TTY at the end of the search simply as the name, department and present assignment of the staff member or members, because the search criteria would be recorded in the search commands.

It would frequently be desirable to have a more formal record of the search and its results, and the following would be a possible product.

HUMAN RESOURCES FILE Result of Search 20-AUG-73

Search Requirement:

Geology
MIddle-East

Staff Members Meeting the Search Requirement:

Smith, J.J.J.	Org. 999	Sr. Saudi Arabia Specialist
Jones, Wilbur	Org. 000	Operations Analyst

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Sample Page Format for Subject Index:

HUMAN RESOURCES FILE Staff Names by Subject 20-AUG-73

	Org	Present SRI Assignment
Sub-subject		
Last name, First names	000	Present SRI Assignment
Last name, First names	000	Present SRI Assignment
Sub-subject		
Last name, First names	000	Present SRI Assignment
Last name, First names	000	Present SRI Assignment
Last name, First names	000	Present SRI Assignment
Last name, First names	000	Present SRI Assignment
Last name, First names	000	Present SRI Assignment
Last name, First names	000	Present SRI Assignment
Last name, First names	000	Present SRI Assignment

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Sample Page Format for Former Employer Index:

HUMAN RESOURCES FILE Staff Names by Former Employer 20-AUG-73

Employer	Dates	Org	Present SRI Assignment
Organization Name			
Last name, First names	66-68	000	Present SRI Assignment
Last name, First names	70-71	000	Present SRI Assignment
Organization Name			
Last name, First names	70-72	000	Present SRI Assignment
Last name, First names	56-60	000	Present SRI Assignment

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Sample Page Format for World Area Index:

HUMAN RESOURCES FILE Staff Names by World Area 20-AUG-73

	Dates	Org	Present SRI Assignment
Saudi Arabia			
Soandso, Harley	45-57	000	Organic Chemist
Lister, Geraldeen	66-67	000	Design Engineer
Somaliland			
Senderson, James P.	65-68	000	Sr. Operations Analyst

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Sample Page Format for Language Index:

HUMAN RESOURCES FILE Staff Names by Language 20-AUG-73

		Ability	Org	Present SRI Assignment
French				
Last name, First names		Speak	000	Present SRI Assignment
Last name, First names		Read	000	Present SRI Assignment
Last name, First names		Some	000	Present SRI Assignment
Spanish				

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APPENDIX A

Sample of Current (May 1972) SRI Skills Inventory

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ACTION-OF-ADDITIVES-
LIPSKA AE

ADVANCED-TRANSIT-SYS-
HENDERSON CD

ADVANCED-TRANSPORTAT
DIXON HL

AIR-POLLUTION-ABATEM
PROCTOR EK

AIR-POLLUTION-ANALYS
PROCTER EK

AIR-POLLUTION-CONTRO
SEMRAU KT
BENEDICT HM
LAPPLE CE
MILLER TP
BROOKMAN MA
PARKS TR

AIR-POLLUTION-DATA-B
GASIDREK LK

AIR-POLLUTION-ECONOM
ELLIS HT

AIR-POLLUTION-FOUNDA
LISTON EM

AIR-POLLUTION-FROM-T
MOON AE

AIR-POLLUTION-STUDY
UTHER EE

AIRBREATHING-PROPULS
MARTIN PJ

ALLOCATION-MODELS
BAUM S

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Sample of SRI Skills Inventory Contents

ALLOCATION-POLICY-RE
MILLER TP

ALLOCATION-THEORY
YU OS

API-LINE-PIPE
TREXEL CA

ARABIAN-AMERICAN-OIL
OLIVER ED

ARABIAN-OIL-COMPANY
SOTOMAYOR MC

ARABIAN-OIL-COMPANY
LEE AE

ATLANTIC-DEVELOPMENT
MILLER VE

ATLANTIC-REFINING-CO
CHAN FY

ATMOSPHERIC-CONTAMIN
LUDWIG FL

ATOMIC-ENERGY
DEMPSTER JW
CHURCH MA

ATOMIC-ENERGY-COMMIS
DAUGHTERTY WL
BENEDICT HM
WHITSON AL
LAPPLE CE
KINDERMAN EM
TOWLE LH
HERNDON JR
MACKENZIE FJ
BENSON SW
CARPENTER GB
OBLANAS JW
MORGAN M
RAINEY CT
SKINNER LSV
MCDONALD GJ
SCHECHTER S
MACKIN JL

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Sample of SRI Skills Inventory Contents

SHAFER CK
SMITH GH
KERNS CG
STEWARD CL
JACKSON DW
BLACK RP
WHITE RK
MENKE MW

ATOMIC-ENERGY-ECONOM
WEIL FE

ATOMIC-ENERGY-OF-CAN
HADDELAND GE

BRITISH-PETROLEUM-CO
CHRISTIE PH

CHEMICAL-PROPULSION
MARTIN PJ
HOUGH RW

CHEMISTRY-OF-COMBUST
WIERSHMA SJ

CHEVRON-RESEARCH
ROBERTS PV
HAYNES DL
HENRY JP

CITIES-SERVICE-RESEA
GREYSON M

COAL----
TREXEL CA
SCHMIDT RA
GREYSON M
LOUKS BM
ALPERT SB
BILLHEIME JW
WENRICK ED
HANSON JH
MACKENZIE JT
BILLHEIME JW

COMBUSTION
PHILLIPS RC
WISE H
WOOD BJ

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Sample of SRI Skills Inventory Contents

```
          BENSON SW
          GREYSON M
          SHAW R
          WOOLFOLK RW
          RIES HC

     COMBUSTION-INSTITTE
          SMITH FT
          SHAW R
          WOOLFOLK RW
          LIPSKA AE
          MARTIN SB

     COMBUSTION-RESEARCH
          CAPENER EL
          ALVARES NJ

     CONSUMER-RESEARCH
          PETERSON GD
          LOTRIDGE MJ
          BEVERETT AJ

     CONTINENTAL-OIL-COMP
          MURRAY RG

     CONTROLLED-THERMONUC
          MARKER KJ

     CONVERSION-OF-COAL
          RADDING SB

     CONVERSION-OF-OIL-SH
          RADDING SB

     DIRECTOR-ENERGY-AND-
          CLARK SH

     ECONOMICS-OF-THE-PET
          ALPERT SB

     ENERGY-----
          FIELD S
          WOOD BJ
          HOAG NL
          CAVENDER JM
          SMITH FT
          STJOHN GA
          LORENTS DC
          ROBERSON JE
```

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Sample of SRI Skills Inventory Contents

```
          TREXEL CA
          CUMMING RC
          BLACK G
          BENSON SW
          SLANGER TG

     FOSSIL-FUEL-CONVERSI
          CLARK CF

     FOSSIL-FUELS
          PHILLIPS RC
          SCHMIDT RA

     GAS-AND-PETROLEUM-PI
          DAVIS PT

     GAS-PIPELINE-NETWORK
          HUMPHREY TL

     GETTY-OIL
          SMITH RW
          BRAY JO

     GULF-RESEARCH-AND-DE
          PETERS HM

     HUNT-OIL-TOOL
          WILDER HB

     INTERNAL-COMBUSTION-
          GRAF SE
          UMHOLTZ PD

     MIDDLE-EAST-OIL-COMP
          BOWDEN P
          PEDERSEN WC
          LEE AE

     MINERAL-RESOURCES
          HARVEY EC

     MINERAL-UTILIZATION
          DAVIS PN

     MINING-ECONOMICS
          SCHMIDT RA

     MINING-INDUSTRIES
          CLARK SH
```

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Sample of SRI Skills Inventory Contents

```
MINING-TECHNOLOGY
     SCHMIDT RA

NEW-OIL-WELL-DRILLIN
     TREXEL CA

NEW-USES-FOR-PETROLE
     TREXEL CA

NUCLEAR-ENERGY
     TREXEL CA
     MERRITT TP

NUCLEAR-POWER----
     HENDERSON CD
     KINDEMAN EM
     ROUSSEAU WF
     JACOBS EE
     HALSEY JF
     BLACK RP
     RODDEN RM
     DAVENPORT SJ

NUCLEAR-PROPULSION
     HALSEY JF
     DEDRICK KG

NUCLEAR-REACTOR--
     WEIL FE
     GILLETTE PR
     HOLBROOK LL
     WOOD ECC
     BLACKWELL EG

OFFICE-OF-COAL-RESEA
     HEISTER NK

OIL-GAS-COAL-AND-NUC
     CLARK SH

OIL-GASIFICATION
     FIELD S

OIL-IMPORT-QUOTA-STU
     ATTINGER H

OIL-INDUSTRY-MARKETI
     WATERS JW
```

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Sample of SRI Skills Inventory Contents

```
OIL-PRODUCTION
     DANFORTH HA

OIL-RECOVERY-PROCESS
     BRATTESAN DN

OIL-REFINERY-PROCESS
     MURRAY RB

OIL-RESERVOIR
     STRINGHAM RS

OIL-SHALE
     SCHMIDT RA

OIL-WELL-THERMAL-STI
     MURRAY RG

OILFIELD-AUTOMATION
     SCHMID HF

PARTITION-ATOMIC-ENE
     BUTLER CP

PETROLEUM-----
     CHURCH MA
     DAVIS PT
     TAKAOKA S
     KLEIN GS
     LOUKS BM
     SPETZLER CS
     HENRY JP
     SMITH RW
     STONG HL
     ROBERTS PV
     ALPERT SB
     DAVIS PT
     KLEIN GE
     TREXEL CA
     KREPICK WA

POWER-FROM-OCEAN-WAV
     JACOBS EE

POWER-PLANT-ECONOMIC
     REULAND WB

POWER-PLANTS
```

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Sample of SRI Skills Inventory Contents

CLARK SH
WOOD EC

POWER-PRODUCTS
FRANK BE

POWER-SOURCES
BIEN A
WEAVER RD

POWER-SPECTRUM-ANALY
UTHE EE

POWER-SUPPLY-DESIGN
WOLFRAM RT
LOMASNEY JM

POWER-SYSTEM-OPTIMIZ
KORSAK AJ

POWER-SYSTEM-PLANNING
MATHESON JE

POWER-SYSTEMS
GARDINER KW
WONG PJ

POWER-TRANSMISSION
BOWDEN P
WHITBY OW

PROPULSION-RESEARCH
WITHERLY TD
MATTISON KW

PROPULSION-SYSTEMS
HARVEY DL

SHELL-DEVELOPMENT
MARTINEZ AP
LEE WW
CURRAN DR
RIES HC
DANIELS NH
OLIVER ED

SHELL-OIL-COMPANYY
WATERS JH
COLSON DH

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Sample of SRI Skills Inventory Contents

ROBBINS RC
HODGES JC
SANDERSON WA
CHOPPING KE

SOLAR-ENERGY-CONVERS
SANCIER KM

SOLAR-POWER-SYSTEMS
BLACKWELL EG

TENNESSEE-VALLEY-AUT
WENRICK ED
HARVEY EC

THERMAL-BATTERIES
WEAVER RD

US-ATOMIC-ENERGY-COM
RODDEN RM
HART PE

UTILIZATION-OF-COAL
MARYNOWSK CW

WATER-POLLUTION-CONT
LOUKS BM

WATER-RESOURCE-EVAL
NEITZEL

WATER-RESOURCES-ENGI
HILL WW

WATER-RESOURCES-PLAN
PICKERING EE

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