Current outline for February ROMAC Report

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The PDP-10 facility	1e1b
Considerations for Design of the facility	1e1c
Adapting non-DEC Equipment	1e1d
Addition of the BB&N Paging Box	1e1e
Monitor + Exec. (JTM)(5 pages; brief rough = 1page)	1e2
Related to Hardware	1e2a
Not Related to Hardware	1e2b
Compiler (DIA+WHP) (7 pages; brief rough = 1 page)	1e3
Convert compiler to produce PDP-10 code on 940	1e3a
Use of Network to bootstrap compiler	1e3b
ReWrite NLS to new compiler language	1e3c
Paging modifications	1e3d
NLS/TODAS (CHI) (10 pages; CHI has some files that will serve as brief rough)	1e4
New Features	1f
Hard Ware (WKE) (13 pages; brief rough = 2 pages)	1f1
Univac drums	1f1a
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Imlac	1f1c
Higher level processes(WLB) (5 pages; brief rough=1page)	1f2
Content Analyser	1f2a
Analyser formatter	1f2b
Collector - Sorter	1f2c
New features in executable text	1f2d

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Bibliography (JCN) (2pages) 1j

Emphasis in this report should be in this order: first on what we need second on what the people who will use NIC need, third on what NET experimentos need, fourth on what other developers of interactive systems can use 1k

Hence, for example, descriptions of a given use of the NET in converting to the new machine should be most developed under section 6 rather than in connection with the NET. 1kl

Page assignments are tentative. Please find contradictions, redundancies etc and tell me about them. 1l

1m

Report schedule 2

```
          Month      >! NO NO NO NO DE DE DE DE JA JA JA JA JA
FE FE FE FE                                                    2a
          Day        >! 07 14 21 28 05 12 19 26 02 09 16 23 30
06 13 20 27                                                    2b
          d=draft  w=write r=review x=other activity CAP MEANS
DONE                                                           2c
 Planning  and start !xxx                                      2d
 Sec.2 Pref credits  !                                         2e
     DVN            >!                 WWW                    2e1
 Sec.6 New features  !                                         2f
     WKE  hdwe      >!      ddd D  WWWWWWrrWWW                 2f1
     CHI  soft      >!      ddD    WWWWWWrrWWW                 2f2
     WSD core NLS+  >!      ddd    WWWWWWrrWWW                 2f3
     JCN jou+B-line >!      dddD   WWWWWWrrWWW                 2f4
     WLB  HLP       >!      ddd D  WWWWWWrrWWW                 2f5
 Sec.5 XDS940 +PDP10 !                                         2g
     WKE  hdwe      >!         ddD      WWWWWWrrWWW           2g1
     JTM monitor    >!         ddD      WWWWWWrrWWW           2g2
     CHI NLS/TODAS  >!         ddD      WWWWWWrrWWW           2g3
     DIA+WHP compr  >!         ddd  D       WWWWWWrrWWW       2g4
 Sec.1 Abstract      !                                         2h
     DVN            >!         ddD      WWWWWWrrWWW           2h1
 Sec.4 ARPA Network  !                                         2i
     WKE connection >!       dddD     WWWWWWrrWWW           2i1
     JTM Net fac use>!       ddd      WWWWWWrrWWW           2i2
     JCN  NIC       >!       dddD     WWWWWWrrWWW           2i3
 Sec.3 Summary       !                                         2j
     DCE            >!              ddd  WWWWWWrrWWW         2j1
     DVN            >!              ddD  WWWWWWrrWWW         2j2
 Sec.7 Future plans  !                                         2k
     DCE            >!              ddd  WWWWWWrrWWW         2k1
```

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```
   Sec.8 Glosssary      !                                                  21
       DVN             >!            wwwrw                                211
   Sec.9 References     !                                                  2m
       JCN             >!                      wwwrrwww                   2m1
       DVN             >!                      wwwrrwww                   2m2
   Sec10 Bibilo         !                                                  2n
       JCN             >!                      wwwrrwww                   2n1
       DVN             >!                      wwwrrwww                   2n2
   DCE approval         !                                 xxx              2o
   SRI edit+approval    !                                    xxxxxx        2p
   Mail good draft      !                                    Feb
  4th>x                                                                    2q
           Day          ! 07 14 21 28 05 12 19 26 02 09 16 23 30
  06 13 20 27                                                              2r
           Month        ! NO NO NO NO DE DE DE DE JA JA JA JA JA
  FE FE FE FE                                                              2s
    Patterns:   /"CHI" OR"Sec"/;                                           2t
Links to inprocess report sections:                                        3
   Sec.1 Summary          (nouhuys,summary:zxbnZD)                         3a
   etc etc                                                                 3b
```

':5247', 12/15/70 1334:00 JCN ; .DPR=1; ':JRNL1', 12/14/70 1538:31 DVN ;
.DPR=0;

16DEC70 DCE 5248

NIC Terms(?): Library, Clearing House, Publisher, Intelligence

Generated these notions during discussion with Jeanne North. 1

Realize that we would do well, for NIC, to describe the different components of service that we, as a NIC, plan for and/or could supply. 2

E.g., the difference between a repositoy ad a clearing houe -- the latter will distribute, help locate, etc. 2a

Difference between a Library and an Information Center. 2b

Reference search, on line -- distinguishing between searching for lirary-held documents, and searching over some reference material (e.g. find all enters with PDP-10s). 2c

What ranges of services do other "information centers" provide? Could be well worth while for our NIC team to visit some of the local Information Centers. 3

Could almost describe our current scope of (near-future) planned actiity as being a combination library and publishing service -- where we store and help people locate and access information tht others generate, and also help some of our clients with the composing and publishing mechanics of their authorship. 4

Another service -- like toward an "intelligence" activiy -- involving going out ad finding more infor, spending considerable energy on analysin and integating, proucing reports, etc. 5

```
':5248', |2/|6/70 |549:34 JCN ; .DPR=|; ':JRNLA', |2/|6/70 |009:|0 DCE ;
.HED="                                                    |6DEC70 DCE 5248

NIC Terms(?): Library, Clearing House, Publisher, Intelligence";
|   .   |   .   2   .   3   .   4   .   5   .   6   .   7
.SNF=72; .MCH=65; .SNB=0; .DLS=1; .SCR=2; .RTJ=0; .PGN=0; .COD[21B]=114B;
.DIR=0;      .DPR=0;
```

A Language And Debugging System For the IMLAC

Two of the major requirements in the manner of support software for the IMLAC are a programing language, and a debugging system. 1

A Programming language. 1a

There is currently in existance an MOL which runs on the 940 and produces code for the Imlac. 1a1

The code produced is then loaded via the high-speed data line into the Imlac with a special loader. 1a1a

Faced with the impending transfer to the 10, we need to consider rewriting the MOL which is available soas to be available on the 10, or providing a suitable alternative. 1a2

In view of the development of L10, the MOL for the 10, and future possibilities, the most profitable direction seems to be towards developing an L-Imlac. 1a3

Using the Tree Meta system, the L10 compiler could be used as a base, in which case the main work would be in modify toing the library produce Imlac format binaries, and changing the code production parts of the compiler. 1a3a

Aditionally, many of the constructs which would not be easily implemented or especially significant to the Imlac would be deleted. 1a3b

Debugging tool. 1b

There are three levels which may be realistically considered here. 1b1

Basic DDT for Imlac. 1b1a

This is a DDT which would run on the 10, yet have a sufficient number of support routines in the Imlac to allow it control of program execution in the Imlac. 1b1a1

It would allow the basic DDT commands for opening, changeing, aand examining cells, breakpoints, searches, etc. 1b1a2

An Imlac program would be loaded by DDT on the 10, and then the linked binaries would be sent to the Imlac for execution and debugging. 1b1a3

A Combined DDT for Imlac/PDP10 1b1b

This would allow debugging of programs which are split between the PDP10 and the Imlac. 1b1b1

Most of the programs which we write will have this characteristic. 1b1b2

It would essentialy work by being able to distinguish between Imlac and 10 code and symbols, and call on the correct library routines for fetches, stores, interrupts, etc. depending on where the coode being examined resides. 1b1b3

It would be advantageous to be able to load and interlink Imlac and 10 binaries, and not, I believe, unduly difficult. 1b1b4

As an example of how addresses might be handled, a flag could be set which indicated the current device being addressed (e.g. IMLAC or 10). 1b1b5

Any address could be then preceded by an escape character (e.g. '.'), which would indicate that the address is for the non-current device. 1b1b5a

This Project is an intriguing one, insofar as it has application far beyond our local world of the Imlac and PDP10. 1b1b6

One of the outstanding problems in the use of networks is the debugging of programs which interact over the network. This project directly attacks this problem. 1b1b6a

Extension of the NLS interactive compiling/debugging system to include the Imlac. 1b1c

This, like the preceding possibility, allows for inclusion of the Imlac and 10 in the same debuging framework. 1b1c1

This project is considerably more ambitious, however, insofar aas it attempts to include the Imlac in a much larger environment allowing interactive compilation and debugging. 1b1c2

This project is very much in line whith our current plans with regard to the 10. 1b1c3

It is probably very difficult, although a careful examination could prove it to be relatively easy. 1b1c4

It has two probable disadvantages, that it is very difficult, and that the completion of such a project is some time away, leaving us with no interim tool for use with the Imlac. 1b1c5

':5249', 12/16/70 1558:12 JON ; .DPR=1; :IMLPRO, 12/14/70 1600:19 WSD ; TO
WKE CHI WHP .DPR=0;

Proposed Multiple File Manipulation Commands for TODAS

Environment. 1

When using TODAS with multiple files, an arbitrary number of files may be open at one time. 1a

One of these files is referred to as the Current File. 1b

All commands which access files refer to this file, unless another file is explicitly indicated. 1c

New Commands and Entities. 2

Two new entities are introduced at the comand language level to facillitate the manipulation of multiple files. 2a

File-id = (NAME/NUMBER/FILENAME) 2a1

The file-id is used to refer to a file. 2a1a

The NAME is a name (LSLD) which the user has equate to an open file. 2a1b

When a file is opened, it is given a number. This is the NUMBER in the File-id. 2a1c

The FILENAME is the normal system file name. 2a1d

File-ref = '% File-id. 2a2

The File-ref may be used as a field in the address field of a command. 2a2a

Any of the following 'in-file' addressing commands are interpreted in the context of the indicated file. 2a2b

It would probably be a good idea to have a CSP for each file. 2a2c

New Commands. 2b

The Syntax described is representative, and the actual TODAS syntax wil differ slightly in order to avoid conflicts. 2b1

'Open file FILENAME,NAME CA ('Input/'Output/'Lock) CA 2b2

This allows a TODAS user to open a file, link it to a psuedonym (which may be used in a file-id), and indicate

whether it is to be read-only (input), read-write (output), or exclusive read-write (lock). 2b2a

Exclusive read-write means that no-other person may access that file while he has it open, and that the open fails if it is currently being accessed by another user. 2b2b

This feature may be hard to implement. 2b2b1

The open comand types a number if it is successful (the number is the file number which may be used in a file-id), and a '? if it fails. 2b2c

'Equate NAME CA to File-id CA. 2b3

This command allows a user to equate a psuedonym to a file. 2b3a

There is an arbitrary limit to the number of psuedonyms for one file. 2b3b

'Lock File-id CA 2b4

This allows the user to Lock a file (see explanation under open) which he has already opened. 2b4a

A '? is typed if another user is accessing the file. 2b4b

'Release File-id CA 2b5

This alows the user to release a locked file. 2b5a

It is a NOP if the file is not locked. 2b5b

'File File-id CA 2b6

This allows the user to designate his current file. 2b6a

The previous current file is not closed by this command, but simply removed as the current file. 2b6b

'Close File-id CA 2b7

This closes the designated file, and releases all psuedonyms. (do we really want to release psuedonyms??) 2b7a

':5250', 12/16/70 1602:27 JCN ; .DPR=1; :TODMFC, 12/14/70 1611:53 WSD ; To
WKE CHI JCN .DPR=0;

Conversion Schedule For WSD

Schedule. 1

Merge: 15DEC-16DEC 1a

Colsort: 17DEC-18DEC, 18JAN-20JAN 1b

Mail: 21DEC-23DEC, 21JAN-22JAN 1c

Journal: 24DEC-5JAN, 25JAN-28JAN 1d

includes time for Xmas and Ano Nuevo 1d1

Executable Text Mods: 6JAN-7JAN, 29JAN 1e

PDP-10 Driver for IMLAC: 8JAN-12JAN 1f

Foundaton for Colsort, Journal, Mail: 12JAN-15JAN. 1g

Details. 2

Merge: 15DEC-16DEC 2a

This is simply an MOL program to be converted. 2a1

Needed for Xref. 2a2

Time includes PDP10 familiarisation 2a3

Colsort: 17DEC-18DEC, 18JAN-20JAN 2b

Two stages: code conversion and debugging. 2b1

Debugging includes somme flopping about in Tenex. 2b2

Mail: 21DEC-23DEC, 21JAN-22JAN 2c

Coding and Debugging. 2c1

Background job will be somewhat of a learning experience. 2c2

Journal: 24DEC-5JAN, 25JAN-28JAN 2d

Coding and Debugging. 2d1

We may need some system work for support. 2d2

includes time for Xmas and Ano Nuevo 2d3

Conversion Schedule For WSD

Executable Text Mods: 6JAN-7JAN, 29JAN 2e

Includes features described in 5218. 2e1

PDP-10 Driver for IMLAC: 8JAN-12JAN 2f

Necessary to use Imlac on PDP10 2f1

May want to do this earlier 2f2

Foundaton for Colsort, Journal, Mail: 12JAN-15JAN. 2g

Includes probably super-processor type of facility in NLS, some file manipulation routines (which may require system work, esp lock and release) 2g1

':525|', |2/|6/70 |606:43 JCN ; .DPR=|; :JRNL3, |2/|5/70 |3|0:29 WSD ; TO
WKE JCN CHI   .DPR=0;

Detailed Description Of Mail System on 10

User Appearance. 1

The user will be provided a command of the form 'Send Message (Branch/Plex/Group/Statement) BUG'. 1a

The designated structure will then be processed by the mail system as a message. 1b

If the message is successfully sent, the bugged statement will be modified by inserting a message header (in the same format of the current message neader) immediately following the statement name. 1b1

If there is an error, a message will be typed or displayed, and the command wll be aborted. 1c

The name field of the bugged statement must contain the list of initials of persons recieving the message. 1d

This field will be transmitted along woth the remainder of the message, which will allow the recipients to determine the identity of other recipients. 1d1

The destination field may be ignored by turning names off. 1d2

If the destination is "ALL", is will be replaced by the proper initials (unless we can think of a better way of handling all). 1d3

The structure is sent under the prevailing viewspecs (with the exception of names off), which means that any analyser/formatter patterns, level clipping, etc. specified will be invoked. 1e

The structure will be modified according to the vviewspecs, soas to reflect what is really sent. 1e1

Implementation Details(send) 2

When a message is sent, it is first checked for proper format (i.e. proper destination field). 2a

Any illegal initials are deleted, and ALL is replaced by the proper initial list. 2a1

The Journal Master Mail File (JMMF) is then loaded, and the number of this message is determined. 2b

This number is, as now, the journal fiile number + the branch nummber. 2b1

If the JMMF is busy, the system waits for some length of time before failing with an appropriate message. 2b2

From this information, a message header (which will include the number) is built, and inserted as the tail of the JMMF. 2c

The structural entity which is the message is now modified via the current viewspecs, and copied as the plex below the new header statement in the journal. 2d

The header statement is marked as 'Not Distributed' with a flag. 2d1

The text from the header is inserted into the original statement immediately after the name. 2e

The JMMF is output and closed. 2f

The command is complete and control returns to the user. 2g

Implementation Details(distribute) 3

Distribution is accomplished by a background job. 3a

It activates itself occaisionally (e.g. every 60 seconds), and loads the JMMF. 3b

It scans through the JMMF looking for messages which have not been entirely distributed. 3c

When one is found, it attempts to open (with lock) the mail file of the recipient. 3d

If it is successful, it insertts the message branch as branch 1 in the recipients mail file, and marks the JMMF to reflect that the message has been sent. 3d1

The recipients mail file is output and closed, and the JMMMF is output and released (not closed). 3d1a

If it cannot open and lock the recipients mail file, it proceeds to the next recipient. 3d2

After all messages have been checked, the JMMF is closed, and the distributer sleeps. 3e

Detailed Description Of Mail System on 10

':5252', 12/18/70 151:43 JCN ; .DPR=1; :IOMIL, 12/15/70 1315:14 WSD ;
TO WKE CHI JCN .DPR=0;

Proposed NLS Features, and COLSORT changes

NLS Features 1

Sort 1a

A sort group command (e.g. 'Execute 'Sort Group BUG BUG ['Length/'Delete Keys/ CA) would be added. 1a1

This coommand would cause the designated group of branches to be sorted in accordance to the keys provided in the top level statements. 1a2

There is no sorting done within a branch 1a2a

The sorting would be done by the rules currently used by COLSORT. 1a3

The only exception to this is that the left and right (or conintue) key delimiters would be settable by an appropriate viewchange command. 1a3a

If delete keys is specified, the key fields are deleted from the sorted file 1a4

Flatten 1b

Flatten is not the optimal terminology for this feature, but will perhaps do for now. 1b1

Representative Syntax: 'Flatten Interval BUG BUG ['Upper Bound BOUND/'Lower Bound BOUND/ CA 1b2

BOUND = BUG/Level indicator 1b2a

A level indicator could be a number (absolute level) or some variation of viewspec levels. 1b2a1

An interval stands for all of the sttements between and including the two bugged statements. 1b3

It differs from a group in that the delimiting statements need not be on the same level. 1b3a

Unless otherwise specified, the lower bound is the level of the lowest level delimiter statements, and the upper bound is the level of the highest level delimiiting statements. 1b4

Perhaps the default upper bound should be the level of the highest level statement in the interval 1b4a

Another possibility for default bound is upper = 1, lower = current value of level clipping 1b4b

When an interval is 'flattened', all of the statements between the upper and lower bounds are moved to be at the same level, the upper bound. 1b5

If any of the 'flattened' statements have a substructure which is not within the bounds, the substructure is carried with the statement. 1b5a

This implies that all of the bound inclusion calculation is done before the flattening. 1b5b

The flattened interval is moved so that the first statment in the flattened interval is the successor of the first up or predecessor of the original of that statement, which is at the level of the upper bound. 1b6

In the event that the beginning of an interval is not within the specified bounds, the 'beginning' of the flatened interval is the first statement following the specified statement, which falls within the interval. 1b7

Colsort Changes 2

The Collector Sorter as we know it will be eliminated. 2a

In it's place, we may use the following approach: 2b

We have a HLP or similar thing which takes a list of files, and merges them into he current file under the prevailing viewspecs. 2b1

The drawback here is the maximum file size (12000 stmts) which may be too small. 2b1a

We need to make sure that merge will work with 'SEND' 2b1b

Having a file of all of the statements we wish to work with, we proceed to flatten it so that the statements (branches) which we wish to sort on are at the first level. 2b2

We now sort, using the new sort construct. 2b3

It should be straightforward to write a HLP which will give us higher level access to these functions if we so desire. 2c

':5253', |2/|6/70 |6|9:43 JCN ; .DPR=|; ':FLATTEN', |2/|6/70 |327:5| WSD ;
To DCE WKE CHI JCN WHP WLB BLP MSC   .DPR=0;

Phone Log: Call from Larry Roberts re. his Jan 6 visit here

He plans to visit ARC on Wednesday, Jan 6, from early in the morning until he has to leave to catch the afternoon plane (3 or 4 p.m.?). He is encouraging Steve Crocker to be here, too. 1

Wants to talk about NIC: 2

> Possible new organizational setup at ARC (as one topic), that compartmentalizes manpower, management, and resources in operational separation from our research actiities. Not much comment about other specific NIC-agenda items, although I gathered that a general review would be appreciated, plus highlighting of any special needs and possibilities that he should be aware of. 2a

Also, he'd like to find out how the IO-transfer process has been going. 3

Another agenda item: he has a problem to discuss regarding a sort of "emergency-situation compter dialogue" system -- to see what ideas and suggestions we might have toward this. From prior phone discussion, I gather that he actually could use a "hard" proposal from someone as to implementing such a thing. Functionally, it sounds very much like at least the basic guts of what our Dialogue Support System is to incorporate, but in his application there would need to be very cheap terminals, provision for users being under severe stress, very high importance on accuracy, etc. 4

> It isn't clear whether or not he would like for us to participate somehow in the specification and development of this system, beyond giving advice. 4a

```
':5254', |2/|8/70 |5|5:53 JCN ; .DPR=|; ':JRNL|', |2/16/70 |756:57 DCE ;
.HED="                                                    |6DEC70 DCE 5254

Phone Log: Call from Larry Roberts re. his Jan 6 visit here";
|    .    |    .    2    .    3    .    4    .    5    .    6    .    7
.SNF=72; .MCH=65; .SNB=0; .DLS=1; .SCR=2; .RTJ=0; .PGN=0; .COD[21B]=114B;
.DIR=0;       .DPR=0;
```

INTELLECTUAL IMPLICATIONS OF MULTI-ACCESS COMPUTER NETWORKS

D. C. Engelbart, Stanford Research Institute

A paper for the Proceedings of
The Interdisciplinary Conference
on
Multi-Access Computer Networks
Austin, Texas, April 1970

1

ORGANISMS AND ORGANIZATIONS 2

I'll take an unlikely start and begin with dinosaurs. I have a six-year-old son who is tremendously impressed and intrigued with dinosaurs. We read and re-read all of the dinosaur books, and every time we go to the library we have to bring home new ones. 2a

Consider a dinosaur (with what little we know and much we may speculate) as a big, monstrous organism whose specialized organs cooperated reasonably well by the then-prevailing standards of "organism design", but whose function was coordinated by a clumsy, crude nervous system and a pitiful little brain. My image of this "clumsy nervous system" can be characterized by the story I've heard (or perhaps this is one that I've invented for six-year-old consumption, and now believe) about an embattled dinosaur not sensing for several minutes that it was dead. 2b

But yet apparently this was an organism marvelously fitted to its environment. The dinosaurs thrived for over 200 million years, as I remember from all those books, much longer than our race has been around. But suddenly -- suddenly in terms of geological time -- they disappeared. 2c

My learned deduction, derived from first-grade scientific literature, is that competition from better-designed nervous systems did them in: better sensors; better sensory-data analyzers (perception); better peripheral contingency decision making (reflexes); better coordination of the functioning of organs, muscles, etc.; better rational analyses of events and history; better accumulation of learned experience; better projection, visualization and planning, etc., etc. 2d

I want to fix in your minds an image of a biological organism that possessed formidable capability within the environment

into which it evolved, but which couldn't make the grade against the competition that a continuing evolution brought into that environment. 2e

Human organizations can be likened to biological organisms, and I find much value in considering the analogy. Organizations evolve too; their mutations are continually emerging and being tested for survival value within their environment. I happen to feel that evolution of their environment is beginning to threaten today's organizations, large and small -- finding them seriously deficient in their "nervous-system" design -- and that the degree of coordination, perception, rational adaptation, etc. which will appear in the next generation of human organizations will drive our present organizational forms, with their "clumsy nervous systems", into extinction. 2f

It is these "nervous-system" functions, within human organizations, where I find the most significant intellectual implications stemming from the forthcoming multi-access computer networks. 2g

AUGMENTATION SYSTEMS 3

For many years I have been developing a research program at Stanford Research Institute aimed at Augmenting the Human Intellect. By intellect I mean the human competence to make, send, exchange and apply to decision-making the commodity called knowledge, as applied toward giving human individuals and organizations more effectiveness at formulating and pursuing their goals. My basic formulation of such a pursuit considers a large system of things to be involved in being intellectual, and being successful at it. A rough but useful categorization of the system's components is as follows: 3a

Biologically Provided Human (BPH) capabilities are the basic components of this "large system" -- e.g., memory, visualization, learning and reasoning, as linked to the human's internal-external environment by sensory-perception and coordinate-motor I/O systems. 3a1

Culturally Provided (CP) items are also basic to this "large system": general things such as languages, methodologies, tools, and training; in specific forms such as algebra, schools, meetings, books, computers, maps and filing cabinets. Also, such items as the value structure, attitudes, motivations, etc. which are so important to the way an individual coordinates and directs his BPH

capabilities, may similarly be said to be "culturally provided". 3a2

An Effective Individual (EI) has a particular system of these CP items built atop his BPH capabilities. Our EI is like a little colony grown around the "raw-material" human, where in number and diversity of items this "ecology" of interdependent dynamics is as subtle and rich as what we are coming generally to appreciate in the "organic" world around us. 3a3

An Effective Organization (EO) is composed of a group of EI components, plus another particular set of CP items associated with their working together. 3a4

These CP items are all candidates for redesign, toward more effective individuals and organizations. To provide a new "augmentation system" for an individual, or especially for a group, is a very complex challenge. Just suppose, for instance, that a really new system had been developed, and consider the problem of checking out a group of people on their "new augmentation system" -- it would involve such as: teaching them new concepts and skills for representing and manipulating information; changing their working and collaborative methods; having them learn new roles and acquire associated new attitudes; changing the format and style for their formulating and communicating, etc. 3b

If the system is to represent a truly significant improvement, assume that the changes to which the new users must accommodate will pervade many levels and facets of the "way of doing their daily work", and that many of these changes will represent radical departures from their prior "ways". The people being given such a new system will have a rough period of learning and adaptation. People don't generally appreciate how many are the "little ways of doing things" that comprise our workaday world, that they may be subtly or radically changed, and that among them might appear a very different distribution of usage and importance. The EI and EO systems are more complex, but therefore richer, domains for development than is appreciated even (especially?) among the technologists in the computer and communication disciplines which have so much potential for changing those systems. 3c

My main message about Augmentation Systems is that, while indeed there are very challenging technical problems involved in supporting tomorrow's Effective Individuals and Organizations, the larger Augmentation System is much more

complex than the technological "subsystem" upon which it depends. We technologists aren't equipped to perceive this sort of thing, and those who are can't generally distinguish the Sunday-Supplement extrapolations from those more probable. It has been my business to struggle with these concepts for two decades now, and the signs that I read at least tell me that the changes in our ways of thinking and working will be more pervasive and extreme than ANY OF US appreciates -- a revolution like the development of writing and the printing press lumped together. The following notions represent some of the least fuzzy elements that I perceive. 3d

THE INTELLECTUAL WORKSHOP 4

In the context of this Conference, it is useful to talk about providing an individual with a "private intellectual work space" -- sort of what his office is supposed to be for him now. 4a

In using his office, an individual goes in, perhaps shuts his door, and spreads his current working information over his working surfaces. He keeps some local files there, does some thinking, some formulating and transmitting of messages to the outside, and receiving returning messages, etc. Some of these transmitted formulations are requisitions for things to be bought, made, commented upon, or etc. He sends them out and results will come back, usually in the form of information -- control feedback, substantive information from colleagues or support staff, etc. He digests, stores, reformulates, responds, and occasionally pursues reflective, creative thought. 4b

The image I'm trying to develop is of an office being the "intellectual workshop" in which one does his collaborative bit within his working environment: one needs work spaces, tools to suit a myriad of tasks, places to store working materials, aids to hold them for examination and shaping -- and they all should be easy to reach, quick to adjust to the task, easy to keep track of, etc. Interactive computer aids will have very significant effects here. 4c

This is the particular area that my group and I have been working on for some six years -- improving the individual's intellectual workshop -- as the first stage of exploring what augmentation might be like. By today's standards, we can demonstrate some impressive features in the workshop environment which we have created to test by our daily use (for doing our daily work). But by our own perspective, as

developed through constant struggle in this domain, we have but a primitive outpost on an unbelievably rich frontier. References 1 through 4 describe our work. I invite you to become acquainted, e.g., with Reference 1. Copies of the movie (Reference 2) are available; viewing this provides the best introduction to our "augmented office". 4d

It will take the explorers of this domain decades to even map its currently visible dimensions. The real rush hasn't begun: this Conference is a meeting of suppliers looking at the prospector trade; we haven't really been giving attention to the developments that will follow the prospecting. 4e

My research group is now moving into a next stage of work that we call "team augmentation". Here, instead of just the individual facilitating his private domain of searching, studying, thinking and formulating, as his office place provides for him, we are exploring what can be done for a team of "augmented individuals" who have in common a number of terminals, a set of computer tools, working files, etc. (as we do) to facilitate their team collaboration. 4f

Our major initial step toward augmenting a team is to facilitate the collaborative dialogue between its members, aiming for new kinds and degrees of collaboration that can thus be achieved. 4g

COLLABORATIVE DIALOGUE 5

To discuss our "Dialogue Support System", consider a shared-file space. This is a common enough thing in today's time-shared environment; but our dialogue-file space comprises "frozen" contributions from the collaborators -- i.e., it represents the "Journal" of transactional entries that make up the collaborative dialogue, entries that are part of the history of things and aren't to be changed. 5a

Assume that you are a participant in this dialogue, as from a CRT terminal in your office. You have just contributed some sort of entry into this Journal -- some tentative formulation of a plan or design. You expect some of your collaborators to be interested. You may have installed an "attention" signal at entry time, aimed at a particular set of people. At their consoles, they either receive an "annunciator" signal to alert them, or may have come across your entry via any number of natural pathways in the course of their work. 5b

These other people can very quickly and flexibly survey your

contribution. At any subsequent time, in any passage of your contribution, one of them can attach a "comment" to any specific entity (e.g., word, string of words, paragraph, drawing, line or label in the drawing). A comment can be one word (e.g., "Congratulations!"), or a reference to a contradictory passage, or a long exhortation about a better way to do the whole thing, other people will be attaching comments at other places, including comments upon other people's comments. What soon evolves from such activity is a network of contributions that represents a full-scale discourse, distributed over time and, if you wish, over space. 5c

A good "office-support system" will provide powerful aids to improve the effectiveness with which one can participate in such a dialogue. For example, one needs speed and flexibility in studying the consequent network of dialogue contributions and in filtering out that which is relevant -- for instance to make a successive version of a plan or design. We are evolving aids for: searching through specified sub-nets and selecting upon such attributes as content, previously assigned descriptive tags, authorship, absolute or relative "publishing" time, and citation linkages; assembling passages from the dialogue, and from one's own notes, with flexible disposition of one's screen into "windows" for independently viewing different materials; easily affixing new links and tags to arbitrary segments of a given memo; conveniently copying into one's own working file a categorized compilation of extracts, etc. 5d

One recognizes, of course, that the existing system of professional journals represents a similar mode of dialogue, distributed as it were over space and time. But the computer-aided dialogue has certain advantages to offer: interchanges in cycle times of minutes or seconds instead of years or months; accommodating more items, and items of much smaller size, without overloading the "clerical system"; accommodating more people making simultaneous accesses and contributions; providing citation followup to exact items (i.e., the computer can take you almost instantly to look at the particular item cited within another "document"). 5e

Within a team that has the kinds of tools and methods that are easily foreseeable, these features are really quite interesting and exciting to consider. We are planning to experiment with this type of collaboration in support of our own system-development activity, within our own shop. 5f

OFFICE-SHARING AND DIALOGUE IN THE ARPA NETWORK 6

Our Augmentation Research Center, at SRI, is a participating site in ARPA's experimental computer network (see References 5 and 6). My group is hoping that here the "augmented office" approach can be applied to a fuller advantage -- i.e., we hope to see researchers at other sites beginning to use the Office for their work, work other than "studying and improving the Office" (which is what my group does). Using our Office system from his home-site CRT terminal, a researcher in computer languages for instance could do the composing, modifying and studying associated with developing his research tools, with setting up and running tests, with integrating the results into his notes, and with communicating and publishing the results. 6a

His experimental programs and compilations may be run on the computer at his home site, or at other Network sites -- there will be means within the Office making it easy to interface to any special tools and data through the Network. The Office is the place where special attention is given to facilitating such supportive intellectual processes as formulating specifications for service requested and for how to present the results and where in the office's records to insert them; there are general needs in this regard over many activities, and the access to all of the special tools being developed in other computer-research areas will be very much heightened if they can be used from an "office" where a unified approach was taken to harnessing these tools. Examples: send your analytic formulation to MIT's Math Lab for processing; Utah's graphic-manipulation processes could construct your illustrations; and the ILLIAC IV can do your heavy computations. 6b

In this network, my group is slated to serve as the Network Information Center, which role offers new ways to experiment with collaborative dialogue. As we ourselves learn how to deal with it within our "conjoint office space", we expect to begin offering use of our "Dialogue Support System", through the Network, to people scattered over the country who want to do collaborative things in pursuit of Network activities. For instance, two graduate students from different universities could work closely together on a project, or a professor at one site could serve as a thesis advisor for a graduate student at another site. 6c

THE KNOWLEDGE MARKET 7

Here is a brief extrapolation into the future and its Augmented Individuals and Organizations, looking beyond both

the ARPA Network and my little experiments with an Augmented Office and a Dialogue Support System. Obviously there will be steadily widening distribution of common-resource accessibility, and a steadily increasing number of people who spend a significant amount of their professional time at terminals. The greater amount and diversity of mutually accessible resources -- human, financial, technological -- will accelerate growth along a number of dimensions. In particular, there will emerge a new "marketplace", representing fantastic wealth in commodities of knowledge, service, information, processing, storage, etc. In the number and range of transactions, and in the speed and flexibility with which they are negotiated, this new market will have a vitality and dynamism as much greater than today's as today's is greater than the village market. 7a

It seems apparent to me that, following this increased mutual accessibility between knowledge resources and consumers, will be the development of more "depth" in the range of both. E.g., just as with the roles of specialty shops and services in some of our industries today, there will be a large number of individuals and small groups each providing highly specialized services. Since their clientele will be drawn from such a large market, they will find a good business even where they serve only a small portion of the market and provide only seldom-needed special services. 7b

Let's look at a specific "for instance". Suppose that one person becomes extremely proficient in making small programs to generate a display or printout to show (particularly well) the status of a multi-task project. He is an independent agent in this multi-access computer network, working at a CRT console in his office at home. Perhaps he specializes in construction projects, and within this perhaps in steelwork erection. You are a management consultant working (from your home) on a short job helping to set up the production-control system for a construction project. When you realized that you might benefit from this kind of help, this is the sequence that takes place: 7c

Your man is easy enough to find because of computer help in searching for and evaluating special products and services. Suppose that you need something he can do for you with about 45 minutes' effort. You expect immediate accessibility for negotiation -- for instance: it takes you one minute to locate several candidates, two minutes to examine their relative credentials, 20 seconds interrogation of public records to select him as being available right now for your

kind of problem, two minutes of personal dialogue to determine for both of you that his capabilities and your needs match, and 15 seconds to negotiate and legalize a contract. He does his job in 40 minutes, and spends five more minutes transferring the results to you (with dialogue). 7d

He switches back immediately to a task sequence whose contract arrangement had permitted him such interruptions. In working on this job, you have been "time-shared" with several other jobs having higher priority, and several that were running "background". During the forty minutes he was off doing his thing for you, your higher-priority task sequences took you off on other pursuits. In fact, when he was done, you weren't ready to get back to him for twenty-three minutes, but the mutual-scheduling algorithm agreed upon in your contract took care of connecting you and him, when you were both ready, for your final dialogue. 7e

Your dialogue, of course, comprised both voice and shared computer graphics. Your mutually viewed display could be flipped back and forth between views of what he called forth on his end to show you, and what you provided to show him. As you were showing him your work domain, he was "catching" reference links into the specific items that he might later need to get at, entering quick notes on some of them. 7f

The whole dialogue was recorded, as a matter of course and for either of you to use later. The stored speech was digitized, and automatically segmented into the alternate passages of your exchange. During your dialogue, whenever one of you referred to a displayed item in your speech, your practice was to make an explicit screen-select action in association with the spoken reference term (e.g., with a "that line" or "both of these figures" expression), so that when any given passage might later be selected for "playback", the computer could re-create for you the image you were seeing and indicate the displayed entity being referenced. 7g

Some of the dialogue had stimulating and instructive contents for you. You wanted to save these and integrate them into your personal notes. Citations to this dialogue are easy to install in your notes, including citations to a speech passage -- where, upon later seeing such a citation and "calling for" the item it refers to, the associated bit string would be found and the speech passage played back for you. 7h

Perhaps you consider some of the speech passages to be useful enough to have them transcribed into text. A quick

designation of your desire causes these speech strings to be transmitted to a service you customarily use for doing your transcription. This service harnesses the latest speech-recognition computer aids, implemented with special-purpose hardware and software, and includes skilled clerical staff who supplement the 98% capability of the machine. Your two-minute transcription job is scheduled through their service units quite automatically, and the text strings are routed back and inserted in their appropriate places without your further attention. You have established the convention with the service agency that un-decipherable or dubious passages will be tagged, and if you had wanted to you could have designated when you sent the job off that you wanted to be interrupted to resolve such when the material returned. 7i

When you and your contractor parted ways, you each might exercise an optional procedure which helps you record your impressions of the other. An important part of your value within this marketplace rests upon your ability to integrate effectively the skills and knowledge of others. So you pay careful attention both to your "intelligence" base which helps you keep track of appropriate people, and to conducting your negotiations and working relationships with an eye for doing well by the other guy -- because he too probably keeps an effective intelligence system and it might well be important to you later that he (or his friends) feels good about working with you. You also need to assess his potential value to you for other and different collaboration. 7j

It is recognized rather widely that computer networks raise significant problems about the privacy of closed information. The other side of the coin is that computer networks raise rather remarkable opportunities to benefit from the sharing of open information. I am quite convinced that there is very high value to be derived within the Computer-Network Knowledge Market from a degree of openness with what have heretofore been considered as private types of information. 7k

Among the members of a working team, this could mean keeping open as a matter of course all of their scratch notes, trial designs, etc. to their colleagues, and expecting them to browse, comment, etc. Once this is the standard operating mode, those aspects of a person's vulnerability that depend mainly upon another's lack of understanding and compassion begin to find a compensating safeguard in the fact that hurtful actions taken therefrom by another person tend also to have complete visibility. This visibility, plus long-lasting

availability of notes and records, would be important to the processes by which each person evaluates his potential colleagues -- which soon becomes important to those concerned with personal growth within this market, and moves toward a lower significance otherwise hurtful actions attempted by those without mature concern for their own growth, or without ability to grow into or stay in a position where their comments and actions are trusted or seriously considered. 71

This may seem unduly naive, I know. But then consider an Afghanistanian villager, whose entire worldly experience is with a primitive every-man-for-himself market: what might it sound like to him to hear a peer suggest that the marketplace would benefit hugely by operating upon the basis of trusting the other man's word. "I say that I will pay you next week for a dozen buns, and I walk away without counting how many buns you put into the bag." Unreal fantasy -- talk of credit accounts, checking accounts, credit ratings, credit cards, etc. What does this have to do with getting the best price for my goat, to deal with abstractions such as accounts, promises to honor, reputation, etc. in a formalized, recorded fashion? Ludricous restrictions and dangerous vulnerability for a system to expect both me and my neighbor (adversary) to reveal our positions, stand behind the things we say and the marks we make, and depend upon the other to do so. 7m

It seems clear that today's Western-world economy couldn't be as strong as it is if such open vulnerability didn't prevail. I only wish that I knew the evolutionary dynamics that produced the attitudes and customs necessary to make the "honest openness" work -- obviously its practice in the Afghanistanian village would lead to disaster, and yet it likely was from just such a market environment that ours evolved. 7n

It seems not unreasonable to assume that survival value in our cultural evolution will favor institutions which support the most efficient Knowledge Markets (organisms which support the most efficient nervous systems). Then certainly the Knowledge Market will someday operate with more open trust in its knowledge interchange, to release for constructive ends a great deal of otherwise entrapped human energy. Those who grow up within such an environment will look back with pity upon the primitive fears and protective practices prevailing in 1970. 7o

SUMMARY 8

I think that tomorrow's institutions can be (must be) far better adapted to their environment, much better at providing for a full life style for everyone. These changes require a very significant increase in the institutions' ability to develop, support, and integrate the intellectual power of their individuals and organizations. And, as I see it, this ability will be directly dependent upon advanced application of interactive computers and multi-access computer networks. But the following condition is very strong in this "implications" picture: to harness this technology toward these ends will require intense concurrent development of our very complex and sophisticated system of concepts, conventions, methods, skills, organizational forms, attitudes, and values. It is time, and the means are at hand, to develop a much improved nervous system for our "social organisms". 8a

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(2) D. C. Engelbart and Staff of the Augmented Human Intellect Research Center, "Augmentation Systems and Information Science", SRI Project 5890, sound film of presentation at ASIS Annual Meeting, October 1, 1969. 3 reels, 1 hour and 34 min. 9b

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(5) L. G. Roberts and B. D. Wessler, "Computer Network Development to Achieve Resource Sharing", in AFIPS Proceedings, Vol. 36, 1970, SJCC, AFIPS Press, Montvale, New Jersey, 1970, pp. 543-549. 9e

(6) L. G. Roberts, "Economic Applications of Multi-Access Computer Networks", paper presented at the Interdisciplinary

INTELLECTUAL IMPLICATIONS of MULTI-ACCESS COMPUTER NETWORKS

Conference on Multiple-Access Computer Networks, Austin, Texas, April 20-22, 1970. 9f

PLANS FOR RADC REPORT DUE FEBRUARY 8TH 1971

PLANS FOR RADC REPORT DUE FEBRUARY 8TH 1971

Report schedule 3

Month	!	NO	NO	NO	NO	DE	DE	DE	DE	JA	JA	JA	JA	JA	3a
FE	FE	FE	FE												
Day	!	07	14	21	28	05	12	19	26	02	09	16	23	30	3b
06	13	20	27												

o=outline w=write r=review x=other activity 3c

Planning and start	!	xxx													3d
Sec.2 ARPA network	!		ooo			ww	ww	ww	ww	rr	ww	ww			3e
Sec.6 Gloss/ref/bib	!							ww	wr	rr	ww	ww			3f
Sec.4 new tools	!			ooo				ww	ww	ww	rr	rw	ww		3g
Sec.1 Summary	!			ooo				ww	ww	ww	rr	rw	ww		3h
Sec.5 Future plans	!				ooo				ww	wr	rr	ww	ww		3i
Sec.3 XDS to PDP10	!				ooo			ww	ww	ww	rr	rw	ww		3j
DCE approval	!											xxx			3k
SRI edit+approval	!												xx	xxx	3l
Mail good draft	!												Feb		
4th>x															3m
Day	!	07	14	21	28	05	12	19	26	02	09	16	23	30	
06	13	20	27												3n

PLANS FOR RADC REPORT DUE FEBRUARY 8TH 1971

PLANS FOR RADC REPORT DUE FEBRUARY 8TH 1971

- Languages 6b1a
- Modification of NLS 6b1b
- Bootstraping 6b1c
- Making use of ARPA net 6b1d
- Monitor 6b2
- Executie 6b3
- System Power on PDP 10 6b4

Irby 6c

- New System Features 6c1
- Short term future plans 6c2
  - NLS 6c2a
    - Development of programming 6c2a1

Duval 6d

- Core NLS---important, architectural 6d1
- Colector Sorter 6d2
- Mail 6d3
- Journal 6d4
- Analyser/Compiler (new use of an old tool) 6d5
- Exicutible Text (combined with colecter/sorter, etc.) 6d6

Some of these items came from the people themselves, others were given to them. 6e

```
':5256', 01/13/71 0928:35 MEJ ; .DPR=1; :5256, 01/13/71 0926:06 MEJ ;
.DPR=1; :RPLAN, 11/04/70 1111:24 JCN;
  .DPR=1;   .DPR=0;
```

ARC FUNDING STUDY
December 21,1970 JCN

ARC FUNDING STUDY
December 21,1970 JCN

ARC FUNDING NEEDS ON RADC (ARPA) 8457: 1

We are not now funded on a straight line basis 1a

$ 2,410.0 k / 24 mo = 100.4 k /mo (23.17 /week) * 17.25 months 8 Feb 70 to 15 July 71 = 1731.9 k vs 1645.0 k funding or short 86.9 k 1a1

At 11/28 we were 42 weeks into the contract 1a2

Straight line spending would be: 973.1 k inc fee 1a2a

We have spent or committed: 988.6 k inc fee 1a2b

We are over the straight line average by: 15.5 k inc fee 1a2c

Transfer to the PDP-10 required early non-labor expenditures 1b

This early spending for the PDP-10 used funds for other needed equipment 1b1

This put us about 15.5 k above straight line 1b2

Without added funding, we must now suspend all additions of people beyond those in process and suspend all new equipment additions until after July 15, to return to predicted line. 1b3

With funding at the straight line level, we could add three 1100/m people about April 1 and still live within our overall personnel budget of 1,203 k 1c

10 periods 3 people less vac/sl 78% sold = 57 k (out of 70 k unassigned to present and three additions presently contemplated now) 1c1

Equipment addition possibilities: 1d

Hardcopy facility 23,800 1d1

Princeton Scan Converter 4,500 1d1a

ARDS Subsystem 6,500 1d1b

Control Logic	5,000		1d1c
Xerox LDX	7,800		1d1d
Conferencing Facility		15,200	1d2
Projection TV	14,900		1d2a
Other Equipment	300		1d2b
Tertiary store		36,000	1d3
RP02s disc storage = $ 36,000			1d3a
1 DF-10 channel 600			1d3a1
Memory cables 550			1d3a2
Disc controller 600			1d3a3
2 drives 1100			1d3a4
Other 150			1d3a5
Additional IMLAC for use at ARC		17,000	1d4
Console Switching Facility		43,800	1d5
Video switch	30,000		1d5a
Grass Valley Group's 1800 series routing equipment (20x30 Routing switch)			1d5a1
Decoding and Control Equipment	13,800		1d5b
Mounting frames 200			1d5b1
Back planes 3,600			1d5b2
I.C.chips 3,600			1d5b3
I.C.interconnectors 1,000			1d5b4
Panel hardware 600			1d5b5
Cables 900			1d5b6

ARC FUNDING STUDY
December 21,1970 JCN

Power supplies	500		1d5b7
Wiring charges	2,400		1d5b8
Miscellaneous	1,000		1d5b9
Ufiche readers		?	1d6
Voice		?	1d7

JCN call to Al Blue ARPA 12/22 am: 1e

I outlined our view of spending, position now, funding relative to straight line, and our feeling of tightness to July 15 71. I also emphasized that we did not plan an overrun at July 15 or at project end, but just feel restricted in our spending for new equipment or added people between now and July 15. 1e1

Al acknowledged that we were being squeezed now, but said that their mid-year budget review was coming up Jan 13, and that they would know after that meeting more about their funding picture. 1e2

We agreed that I should check in with him again later in January. 1e3

ARC FUNDING STUDY
December 21,1970 JCN

RADC 8457 ONLY: $ 000 total cost (11/28 on) 2

Period	Labor	Facil	Other	Commit	Cumul		
							2a
to date:	447.8	380.4	←	118.2*	946.4	*(commit8457)	2b
13	44.5	43.4	2.0		1036.3		2c
1	34.8	43.4	2.0		1116.5		2d
2	44.7	32.0	2.0		1195.2		2e
3	45.0	27.0	3.0		1270.2		2f
4	42.2	27.0	2.0		1341.4		2g
5	42.2	27.0	2.0		1412.6		2h
6	44.2	27.0	2.0		1485.8		2i
7	44.4	27.0	2.0		1559.2		2j
To July 3 for funding purposes:							2k
Subtot>	789.8	634.2	17.0	118.2	1559.2	of 1575.0 available	2l
(unassigned funds to help after 7/3: 15.8)							2m
To end of contract February 8,1972:							2n
8	45.8	27.0	2.0		1634.0		2o
9	45.8	27.0	2.0		1708.8		2p
10	45.8	27.0	2.0		1783.6		2q
11	45.8	27.0	2.0		1858.4		2r
12	45.8	27.0	2.0		1933.2		2s
13	45.8	27.0	2.0		2008.0		2t
1	45.8	27.0	2.0		2082.8		2u
1/2 2	22.9	13.5	4.0		2123.2		2v

ARC FUNDING STUDY
December 21,1970 JCN

Subtot>	343.5	202.5	18.0		2123.2	2w
Totals	1133.3	836.7	35.0	118.2	2123.2 of 2306.7 available	2x

Unassigned funds (without fee) 183.5 2y

(From the Personnel estimate: 70.0) 2z

(From the Non-labor estimate: 113.5) 2a

Actual commitments 11/28/70 (excluding monthly facility leases and maintanence costs): $ 2aa

8457-10	BBN	1350	PO A54324	2aa1
8457-20	BBN	75	PO A54062	2aa2
8457-20	BBN	54000	PO A13478	2aa3
8457-20	Bryant	3018	PO A54233	2aa4
8457-20	XDS	2055	PO B52029	2aa5
8457-20	AJ	77	PO B53826	2aa6
8457-20	AJ	97	PO B51676	2aa7
8457-20	AJ	120	PO B52159	2aa8
8457-20	Duplex Prod	595	PO A73085	2aa9
8457-20	Carter Rice	64	PO A54372	2aa10
8457-20	XDS	690	PO B53582	2aa11
8457-20	DEC	76	PO A73103	2aa12
8457-20	Cybernex	1100	PO A54309	2aa13
8457-20	Cybernex	5446	PO A53875	2aa14
8457-20	Cybernex	5545	PO A53937	2aa15
8457-20	Cybernex	18669	PO A54033	2aa16
8457-20	Bay Engin	24556	PO A51066	2aa17

ARC FUNDING STUDY
December 21,1970 JCN

8457-20	Storm	21	PO	A69964	2aa18
8457-20	Conrac Corp	26	PO	A69693	2aa19
8457-20	Sunbrite	190	PO	A68777	2aa20
8457-20	Wanlass Elect	21	PO	A68405	2aa21
8457-20	Weatherford	76	PO	A69784	2aa22
8457-20	Western Union	33	PO	A71551	2aa23
8457-20	PA Ans Serv	240	PO	B73018	2aa24
8457-20	Boise Cascade	34	PO	A73043	2aa25
8457-20	Bates	40	PO	039504	2aa26
Total Commitments:		118214			2aa27

ARC FUNDING STUDY
December 21,1970 JCN

Monthly and period facility costs 3

Computer Facility Support revised 12/14/70 3a

Lease Cost after 9/70	monthly	period		3a1
XDS 940:	$ 17,554	16,325		3a1a
Univac drums	6,723	6,252		3a1b
Line Printer	1,038	965		3a1c
Terminal rental	1,295	1,204		3a1d
Maintenance and Operation	1,563	1,454	(too high??)	3a2
Telephone expenses	1,454	1,352		3a3
Subtotal	*** 29,627	27,552	*** use: 27.0 k	3a4
plus: PDP-10:	16,717	15,547		3a5
Total	*** 46,344	43,099	*** used: 43.4 k	3a6
less: XDS 940:	17,554	16,325		3a7
Total	*** 28,790	26,774	*** use: 27.0 k	3a8

ARC FUNDING STUDY
December 21,1970 JCN

Combined ARC PROJECTS: $ 000 personnel cost only (11/28 on) 4

Period	8457	8622	New ONR	Total	Need (sold)	
						4a
to date:	447.8	11.4	-			4b
13 pres	44.5	3.1	-	47.6	47.6 (85%)	4c
1 add	34.8	4.0	-	38.8	38.8 (75%) 1	4d
2 more	44.7	4.5	-	49.2	49.2 (80%) 2	4e
3	45.0	4.5	-	49.5	49.5 (80%)	4f
4	42.2	4.5	-	46.7	46.7 (75%)	4g
5	42.2	4.7	-	46.9	46.9 (75%)	4h
6	44.2		3.0	47.2	47.2 (75%)	4i
7	44.4		3.0	47.4	47.4 (75%)	4j
To July 3 for funding purposes:						4k
Subtot>	789.8	36.7	6.0			4l
To end of 8457 contract February 8,1972:						4m
8	45.8		3.0	48.8	48.8 (78%)	4n
9	45.8		3.0	48.8	48.8 (78%)	4o
10	45.8		3.0	48.8	48.8 (78%)	4p
11	45.8		3.0	48.8	48.8 (78%)	4q
12	45.8		3.0	48.8	48.8 (78%)	4r
13	45.8		3.0	48.8	48.8 (78%)	4s
1	45.8		3.0	48.8	48.8 (78%)	4t
1/2 2	22.9		1.5	24.4	24.4 (78%)	4u

ARC FUNDING STUDY
December 21,1970 JCN

Subtot> 343.5 4v

Totals 1133.3 out of 1203.3 (70.0 under orig personnel budget) 4w

ARC FUNDING STUDY
December 21,1970 JCN

ONR 8622 ONLY: $ 000 total cost (11/28 on) 5

Period	Labor	Non-lab	Cumulative		
to date:	11.4	0.5	11.9		5b
13	3.1		15.0		5c
1	4.0		19.0		5d
2	4.5		23.5		5e
3	4.5		28.0		5f
4	4.5		32.5		5g
5	4.7	0.5	37.7		5h
Totals	36.7	1.0	37.7	(of 37.7 available for costs)	5i

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- 28DEC70 DCE 5258

Phone Log: Call to DCE from Jerry Elkind

He's now an assistant prof. at the Sloane School of Business Administration, MIT (and also associated with Project Mac, where he has an office). (Room 80h, 545 Technology Square, Cambridge) 1

Has inherited the ONR project, which used to be run by Malcolm Jones and Bob Goldstein. 2

Jerry is interested in taking it into a more user-oriented and experimental domain, rather than into the file-structure domain as it seemed to be headed. 2a

Currently thinking of developing a modelling facility specially aimed at experimenting with models of organizations. Wants to have people really do experimental work with it; furthermore, wants the modelling system to be able to handle the experimental organization in which his modelling and testing will take place. 2b

We talked of cooperating in various modes: he's very interested in trying to get an IMLAC linked through MULTICS and the Network to NLS. Seems interested in considering further cooperation after that: 2c

I described briefly the "NLS Office" plan that we were working toward. 2c1

Also told him about our stress on system-development-project management. 2c2

And also mentioned hope of doing a cooperative biblio development (intelligence system) among the various people (such as his group, and Goldberg's SRI/ONR project). 2c3

Is preparing a seminar for next semester on "interactive systems," languages, etc. 3

In this regard, he wanted to know whether we could let him have a copy of the ASIS movie for a month or so. 3a

Agreed to get him a copy by Jan 11, to keep until after mid-February. Between his initial viewing and his showing for his seminar, he will be willing to manage some interim East-Coast loans to us. 3a1

He also wanted a more complete set of our publications, to put in the Sloane Library. I agreed to send him what we could. He already has the two 1970 project reports. 3b

Phone Log: Call to DCE from Jerry Elkind

```
':5258', |2/29/70 0716:58 MEJ ; .DPR=|; ':JRNL3', |2/28/70 |443:26 DCE ;
.HED="                                                    28DEC70 DCE 5258

Phone Log: Call to DCE from Jerry Elkind ";
|    .    |    .    2    .    3    .    4    .    5    .    6    .    7
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Notes on Computer Networks, Markets, Organizations, Intellect

The bulk of these notes was developed in late March, 1970, toward getting oriented for a presentation at the Inderdisciplinary Conference on Multiple Access Computer Networks, to be held in Austin, Texas, April, 1970 -- See (Journal,5255,) for the paper that was developed for the Proceedings (long after the Conference; not much like the actual talk). Branch 4 was apparently a similar bit of scratch work in May, preparing for a talk to a seminar on Computer-Aided Design at Stanford (Bernie Roth). 1

Notes from ICMAC early preparation. 2

With forseeable extension to current development in interactive techniques, we can expect the user of a private interactive computer system to become considerably more effective at his intellectual pursuits. Replacing the private system with a "multi-access network" will have added impact upon human intellectual capability stemming both from the obvious increases in service/cost ratio and from the new level of intellectual interaction made possible among individuals. 2a

2b

For both of these effects, there will be aspects of value due directly to increased access to people, hardware, and software, and to the sharing of the costs of the latter two, Also, possibilites for unprecedented effectiveness in collaboration will stem from remarkably improved modes of intellectual dialogue. Not so apparent, but extremely important to both cost and intellectual interaction, will be the "market dynamics" evolving within what represents a most fluid and novel marketplace -- the multi-access computer network.

Notes on Computer Networks, Markets, Organizations, Intellect

2c

**** **** 2d

What these conditions are will be part of the paper -- then what this requires of the technology in the Net development. 2e

With an extension of such conditions, we can expect considerably more increase in the intellectual effectiveness of a team of such workers when they can communicate through the computer network. 2f

What characteristics must prevail for this to happen? 2g

Good structural representation of his 2g1

Fast, flexible means for composing or modifying -- in the conceptual frame of the particular portrayal currently being shown. 2g2

Fast, flexible means for studying. 2g3

navigation 2g3a

portrayal 2g3b

(2) What characteristics must prevail for this to happen? 2h

The storage organization must be capable of incorporating an unambiguous representation of the working concepts 2h1

complete representations of kernel concepts 2h1a

plus complete representation of those relationships between the concepts that are involved in the manipulations and portrayals of the conceptual matter. 2h1b

The user must have a 2h2

trial 2i

Dialogue 2i1

Integrate contributions better from many sources, including one's own that are distributed over the past minutes or years. 2i1a

Notes on Computer Networks, Markets, Organizations, Intellect

Finding and acquainting one'self with others and their work 2i1b

becoming involved, able to evaluate the others, lets one better coordinate his associations and contacts 2i1c

Marketplace 2i2

therefore he can expect wide variety of services and functions, 2i2a

can expect them to evolve rapidy because there will be competiton 2i2b

What does marketplace competition promise for the evolution of the individuals's utilization, skill development, etc.? 2i3

Each person (group) will be much more "visible" 2i3a

like difference between observing and judging football players at work or ... 2i3a1

Competition and fluid market shifting will 2i3b

reveal his relative strengths and weaknesses more clearly (to guide his development and marketing) 2i3b1

prduce competitive incentive -- the better people will really show up 2i3b2

There will also be an extended market for the services of individuals, especially "knowledge workers" (cf. Drucker) 2i4

i.e. can quickly enlist a worker, independent of geography, into a task and role structure 2i4a

When one worker, or group of workers, becomes more capable than another, there will be a fluid market mobility toward better clients and better conractors. ; 2i5

One can seek advice and help, over wide range of topics and levels, from many people. 2i6

They can be contacted for very brief periods without much overhead for eitner party, so mini-trasactions will become more used 2i7

Notes on Computer Networks, Markets, Organizations, Intellect

Notes on Computer Networks, Markets, Organizations, Intellect

incentive 2j2e

competiton 2j2f

Trial 2k

To discuss this market business, 2k1

to avoid over-limited images -- instead of talking about employer-employee, manufactuer-buyer, etc., we'll use the terms "contractor" and "client." 2k1a

A contractor ready to provide goods, services at a price, where the services might be his own labor, his team's, or etc. and 2k1a1

A client being the party who wants to avail himself of goods or services and is ready to pay a certain price. 2k1a2

Some client-contractor characteristics 2k1b

Obviously, some contractors can deliver more satisfaction to a given client for a given price 2k1b1

And some clients can better utilize (harness) and pay for a given contractor's services. 2k1b2

The needs and capablities of each party change with time, and a best match would usually call for continual shiting in the structure of who contacts with whom for what. 2k1b3

Characteristics of a good market (as seen by an individual party needing to negotiate both client and contractor contracts): 2k1c

The relative merits of candidate contractors and clients are more visible to him 2k1c1

It is easy to communicate and negotiate with The candidates 2k1c2

It is relatively easy to discern one's own strengths and weaknesses as seen in the client and/or contractor market. 2k1c3

Notes on Computer Networks, Markets, Organizations, Intellect

One can see explicit steps toward improving his desireability -- learn, reorganize, strengthen, etc. 2k1c4

as oppossed to not being old enough, or the right color, sex, religion, school, or tall enough) 2k1c4a

There are enough to choose from that his shifting from one to another doesn't devastate the opportunity for the one to continue existing 2k1c5

You don't like to fire old Smithers, even if he's a marginal mechanic and you don't get along with him well, because you run the only garage in town and who would hire him to do something else that he does worse than car fixing? 2k1c5a

However, if there is a relatively active market for mechanis, Smithers will move around until he either finds a role and a boss where he isn't marginal, or else he sifts out the bottom as one whom the garage environment cannot accommodate -- where it was a well-tested decision by this environment. 2k1c5b

It is relatively easy to make the transition between doing business with one client (contractor) and taking up with another. 2k1c6

i.e., not difficult to arrange timing, transfer of information, rearrangements in your system to accommodate the new party's special characteristics, etc. 2k1c6a

There are enough gradations of role requirements that one can make the transitions to a next-higher-challenge role by a reasonable transient period of extra effort. 2k1c7

Characteritics of a limited market: 2k1d

Difficult to become aware of candidates, to be able to evaluate them 2k1d1

Hard to communicate with them (eiher to gain access, or to have a good language or communicaing relationsnip,..) 2k1d2

Hard to negotiate -- lack of flexibility, of openess, of clarity of need, possibility, value and cost, ... 2k1d3

Few choices, in people to collaborate with, to work for, to hire 2k1d4

Difficulty in changing working relationships -- either in changing to a boss that is better, or in replacing an employee. 2k1d5

Such a "sparse" market that there is too large a step in requirements (or price) between current client (or contractor) and the next better one. 2k1d6

You can't improve your position without the benefit of the new relationship, but in the current relationship you can't gain the position (resurces, capability,..) to swing the next one. 2k1d6a

Everybody benefits from being able to adjust his working relationships as the environment changes, and as his needs and capabilities change. 2k1e

Changed-market aspects of Multiple Access Computer Networks: 2k2

Notes 2k2a

Information-handling resources 2k2a1

Hardware 2k2a1a

Processors 2k2a1a1

Communication Links 2k2a1a2

Terminals 2k2a1a3

Storage facilities 2k2a1a4

Software 2k2a1b

File management 2k2a1b1

Transaction monitoring and accounting 2k2a1b2

Communication 2k2a1b3

Personal augmentation 2k2a1b4

Team augmentation 2k2a1b5

Utility services 2k2a1b6

Human resources 2k2a2

Contractors 2k2a2a

information consultants or guides 2k2a2a1

Continuing service 2k2a2a2

Special project 2k2a2a3

Clients 2k2a2b

Students 2k2a2c

Knowledge-worker environment 2k2a3

Information-handling resources 2k2b

There is good chance for open competition to exist in the information-handling services available to any given party: 2k2b1

Different hardware facilities should be able to be integrated into the Network, to offer parallel, competetive service for processing, storage, transmission, or I/O. 2k2b1a

Different software, in the same or different hardware configurations, can offer competitive services for operatin on clients data, or supporting his programming and operations. 2k2b1b

Conversion, for a client to transfer his business from one contractor to another, would become a matter for a new degree of concern by the contractors. 2k2b2

Much smaller incremental effort likely to be involved, since a client does not need to 2k2b2a

install and maintain an altered computer installation to consider a change 2k2b2a1

or feel collaterally responsible for forcing other users into changed processes or rate structures when he changes his "configuation". 2k2b2a2

To a contractor, adapting to smaller relative changes in a clients needs would become more important as the threshhold becomes ever smaller for the amount of unsatisfied need at which a client will switch contractors. 2k2b2b

Tn effect of this on attention to conversion -- 2k2b2c

contractor would essentially need to make flexible changes come easily, to keep customrs from wandering. 2k2b2c1

What's the differnce between this and conversion -- 2k2b2c2

If contractor cmes up with 2k2b2c3

Say a contractor is pushed by competition to come out with a rather radical change in a system -- he'll need to fight to keep his customers, and the difference often will be affected by the ease of converting to a new service. 2k2b2c4

this conversion facility will become an important competitive issue 2k2b2c4a

To keep old customers if come up with a radically changed new service in heroic effort to meed competition. 2k2b2c4a1

To try to get new customers away from existing services with competitor contractors. 2k2b2c4a2

Hardware 2k2b3

Software 2k2b4

Human resources 2k2c

Contractors 2k2c1

Clients 2k2c2

Students 2k2c3

Knowledge-worker environment 2k2d

The intellectual impact will come from several factors which will increase significantly: 2k3

resources for any individual -- data, helpful processes, access to other minds 2k3a

dialogue capability with these other minds 2k3b

personal mobility and power for searching, interrogating, analyzing and integrating 2k3c

coordinative capability -- enabling teams to form quickly and attack very effectively very complex and urgent problems 2k3d

inter-personal visibility, wareness, evaluation 2k3e

Competition ranging over much more detaled substrictue of activity for individual n teams. 2k3f

The result will be a radical change in the whole intellectual, workaday, career-development environment. 2k4

Schools will be much less a formal, isolaed period of one's life or day 2k4a

Learning will be integrated with your involvment during all the days of your life 2k4a1

Much higher personal mobility to 2k4b

evolve into capability (knowledge and skill) areas best suited, 2k4b1

evolve role structures best suited to a given task and task team 2k4b2

see one'self clearly in relation to others (in skills, knowledge, reputation,..) and see what he can do to improve his standing. 2k4b3

Notes on Computer Networks, Markets, Organizations, Intellect

see and evaluate other people, and to negotiate for the services (or even products) of those with best value to you 2k4b4

Notes from actual ICMAC prepartion 3

Introduction 3a

Intellectual -- clarify: dinosaur, library, organism, survival, ecology 3a1

Liken human organization -- computers and MACN like nervous system basics directly talk of equivalent sensory, memory, reflexive speed 3a2

Intellectual part is built on this, perception, visualization, creativity, rational thought, self training 3a2a

Since worth of MACN quite apparent in increased effectiveness of organizations, this seems reasonable for intellect -- concernd with increased effectiveness of human organizations and institututions by knowledge processing at higher levels. 3a3

Drucker concept, knowledge worker, supports this model all along 3a4

Considering then, changes in this part of organization, and implications in ecology of the organizations. 3a5

Office model 3b

private domain for study, formulate, launch and receive, equivalent place to I/O-edit block (P2) in DIck Raymond's model. 3b1

This characterizes area of my work .. let me make it a bit real for you. 3b2

System approach, bootstrapping, system-development group, facilities 3b2a

Slides 3b2b

people at consoles and meeting, display and eidophor (presentaions and movies) 3b2b1

among teamates -- much openess, but saturation with information and interruption possible (consider closed-circle model 3d2a1

the open team will be the more effective team, competition will push hard to overcome attitudes and surmount problems 3d2a2

and bigger -- 3d3

Service institutions, like libraries and universities 3d3a

serving not only in much different environment, but dealing with very much different clints. 3d3a1

Conclusions 3e

Assuming that natural forces bring this about, need a new discipline (science and engineering). 3e1

Su (21 May 70) EE Seminar 4

NP notes 4a

System organizations to come -- network, with processor and storage capacity distribed among the nodes in some fashion 4a1

Need for a "professional" in a given discipline to have a value framework -- for that discipline, and for himself (perhaps also for his employer). 4a2

Physical communication, to and from humans, ever more important. 4a3

4a3a

Slide candidates 4a4

People, consoles, meetings 4a4a

Dialogue sequence 4a4b

Display CRT, Eidophor 4a4c

NLS as Vehicle 4a4d

Bootstrap sequence (3) 4a4e

Notes on Computer Networks, Markets, Organizations, Intellect

Interactive-computer support of human intellectul endeavor 4b1a1

Multi-access computer networks, andparticularly the ARPA Net 4b1a2

The meaning I give to "intellectual" here, and the general relavance to human institutions of the computers and networks. 4b1a3

General look at my current research activity 4b1a4

Type of implications forseeable, to individuals, organizatons 4b1a5

First, though, talk a bit about goals and values: 4b1b

It is open to an individual to consider the various effects and by-products of his professional endeavors. 4b1b1

Suppose that he has a particular set of values and that he wishes to optimize the worth of these products of his efforts accordingly. 4b1b1a

Realize that there is generally no framework, in any of the university-taught proessional disciplines, in which to treat such a problem -- there aren't the vocabularies, the condepts, the formulations and data, and most importatly there aren't the attitudes that this is an important part of a person's becoming a pofessional (and thus warranting a place in university or later professional activities). 4b1b1b

For a specially trained graduate student, say at age 25, there lies before of him a considerable resource expenditure within the general framwork of professional activity. In terms of his personal time alone, he has about 5 million minutes over whose application toward results he has a good deal of control. 4b1b2

The question is, then, what does he want to see done, to have changed in the world because of that investment. What return does he seek? 4b1b3

Notes on Computer Networks, Markets, Organizations, Intellect

My serious review of this at age 26 led to a big change in my life -- and the entire content of this talk directly reflects this.. 4b1b4

Ask how it is provided for any individual to review his value struture, scout the terrain ahead, select goals and routes, invest intelligetly toward those goals, review intelligently his progress and possible need for change in values, goals, or etc.? 4b1b5

And for human organizations, even more critical and difficult. Soit is toward some help in this process that I decided toinvest my career. 4b1b6

Human Intellect, and Organizations. 4b2

Intellectual -- clarify: dinosaur, library, organism, survival, ecology 4b2a

Liken human organization -- computers and MACN like nervous system basics directly talk of equivalent sensory, memory, reflexive speed 4b2b

Intellectual part is built on this, perception, visualization, creativity, rational thought, self training 4b2b1

Since worth of MACN quite apparent in increased effectiveness of organizations, this seems reasonable for intellect -- concernd with increased effectiveness of human organizations and institututions by knowledge processing at higher levels. 4b2c

Drucker concept, knowledge worker, supports this model all along 4b2d

Considering then, changes in this part of organization, and implications in ecology of the organizations. 4b2e

My current work 4b3

Office model 4b3a

private domain for study, formulate, launch and receive, equivalent place to I/O-edit block (P2) in DIck Raymond's model. 4b3a1

Notes on Computer Networks, Markets, Organizations, Intellect

Tertiary organizational effects -- new forms, new marketplace for organizational transactions, 4b4a5

Instances and examples 4b4b

Close in -- console, command language, etc. -- many kinds co-exist in MACN, but for one user, uniformity in both over range of activity 4b4b1

Skills, knowledge, radical changes in what's required to stay competitive 4b4b1a

Attitudes most important (esp during transition) 4b4b1b

Bigger sphere 4b4b2

privacy vs. openess issue 4b4b2a

among teamates -- much openess, but saturation with information and interruption possible (consider closed-circle model 4b4b2a1

the open team will be the more effective team, competition will push hard to overcome attitudes and surmount problems 4b4b2a2

and bigger -- 4b4b3

Service institutions, like libraries and universities 4b4b3a

serving not only in much different environment, but dealing with very much different clints. 4b4b3a1

Conclusions 4b5

Assuming that natural forces bring this about, need a new discipline (science and engineering). 4b5a

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A Baseline for File Systems on the PDP10, With Emphasis on the Library File System

Overview 1

File Handling Service System 1a

The FHSS is a library of routines (modules) which perform basic operations on and with files. 1a1

Basic operratio operations include storage allocation, backup, low-level directory maintenance, openning, closing, locking, retrievlal, and similar functions. 1a1a

This library serves as a base for writing File systems. 1a2

Although the FHSS will initially be accessable to only qualified programmers, it will be eventually interfaced in such a way so as to be useful to a user writing a HLP. 1a3

File Systems 1b

A file system is a relatively high level program (or set of programs) which enable a specific user or anotherr system to mminpulate files. 1b1

The file handling functions of a file system will be implemented by calling on routines in the FHSS. 1b2

Examples of File Systems are Archive Storage Systems, 'Personal' user file directory manipulation systems, Automaatic Backup File retrieval systems, and others. 1b3

Note that a File System may do many operations other than ones directly concerning files, The main restrictions being that it be (1) high-level, and (2) concerned with file handling at some point. 1b4

This is a relatively simplified model. 1c

Whielile it is conceptually convenient to divide the world into 'service systems' (in this case file manipulation libraries) and 'users' (file systems), it is not so simple in real life. 1c1

One anomoly which is especially important is the bootstrap situation, where in this case a file system is used by some other file system as an element of the FHSS. 1c2

Our design should explicityly allow for this important

mobility, and any File system should be considered a candidate for the FHSS. 1c2a

This particular feature ties in very stroongly with the concept of HLP's (where one HLP May invoke other HLP's) which suggests that by making the basic FHSS accessable to HLP's, and implementing File Systems as HLP's, the desired facility may be automatically provided. 1c2b

Library File System 2

The Library Files System (LFS) is a specific file system which jis designed to support the needs of ARC/NIC library systems. 2a

The Journal, NIC, RINS collection, etc. are library systems. 2a1

The primary features of the LFS will be: 2b

-Automatic allocation of second , third and (potentially) lower level storage. 2b1

Files within the scope of the LFS will be moved between the various levels of storage according to an accesability criterion. 2b1a

The criteria will be a function of storage availability, frequency of access and time since last access, age of file (including consideration of superceding versions), priority of file, access requests, and storage device characteristics. 2b1b

-Automatic Retrieval of files in the system 2b2

At the highest level, an attempt to open a file which is in the LFS will initiate retrieval mechanisms to bring the file into a storage medium which may be readily and directly accessed by an NLS user. 2b2a

If the retrieval request is likely to take a long time (e.g. 1 min or more), the user opening the file mmay be allowed to abort the open reques and either have it ignored, or ask the LFS to retrieve the file regardless for a later attem 2b2a1

at opening it. 2b2a2

-Automatic File Maintenance 2b3

While this may be assumed to be a function of any File System, we mmntion it here because it is especially important to be able to enter a file into the LFS, and then subsequently disregard it except for accessing. 2b3a

A complication in maintenance arises when we begin to consider back links and comments such as we will want in the dialogue system. 2b3b

A solution to this problem seems appropriately deferred (although not compelletely ignored) until we decide how we are going to do back-links and set manipulation. 2b3b1

-TENEX File Handling Capabilities 2b4

It seems highly desirable to think of the LFS capabilities as extensions to the normal TENEX file handling capibilities. 2b4a

Thus a system using the LFS will not only have access to the special tools mentioned, but also to all of the normal TENEX file handling tools. 2b4b

Implementation Baseline (6-10 weeks) 2c

Detailed Specification (2-3 weeks) 2c1

Defining specific modules needed in FHSS, and necessary interfaces. 2c1a

Searching out and defining interfaces and modifications necessary to TENEX to accommodate. 2c1b

Specifying interface of LFS to library systems (and, presumably, operators/users) 2c1c

Module Design (1-2 weeks) 2c2

Detail specification of logic flow, etc of modules. 2c2a

Coding (1 week) 2c3

Includes modules, interfaces, and Necessary TENEX changes 2c3a

Debugging (2-4 weeks) 2c4

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08JAN71 DCE 5262

Memo: Considerations regarding extending 940 lease

It seems reaonably probable at this time that we will not have NLS up for general use by the Feb 7 date scheduled for 940 removal. It also seems likely that we could arrange a short-term extension of our 940 lease, to allow us to continue operating parallel sytems until the NLS10 would be in better shape. This memo states my present attitude about the matter. 1

We are very much pinched for cash over the next six months -- see(5625, 2b1). However we could find ways to borrow from our next period, nibbling away at the $110K or so that our budget has reserved for special items such as moveable-head disk lease, frame-jump microfiche system, graphic-printer system, speech-string I/O equipment, and/or etc. 2

Bill English is going to find out about the conditions of cost etc. under which we might extend the 940's stay; and we can certainly consider it if the need seems great enough, relative to these other items, and relative to the worth to our whole effort of having the 940 for a longer period. 3

We now pay something like $18K/month for the 940 equipment that will be leaving. This is a sizeable resource module, but not overwhelming. Relative worth of other things, within my framework now, is expressed by the following: 4

I think I would rather have the $18K than a month's access to NLS for the NIC and our other ARC operations. However, if the gap were going to extent to two months or longer, I would have to reconsider -- something like, "we could hold our breath for a month, but we'd begin to suffocate somewhere beyond that." 4a

A critical issue then is the value to the NLS10 development of having the 940. If losing the 940 on 7 Feb would cause a two-month gap, but keeping the 940 would get NLS10 going in a month, then I think I would vote for a month's 940 extension if there is some way we could arrange it. 4b

But if losing the 940 on 7 Feb meant that there would be up to a months gap for NLS, and that the 10-development team was somewhat hampered but not crippled by losing the 940, then I think I would feel like dropping the 940 and holding our breath. 4c

I will welcome hearing other thoughts on the matter, and be happy to reconsider my position via dialogue with other considerations; but having exprssed these above thoughts, I shall otherwise await

Memo: Considerations regarding extending 940 lease

developments. If there evolves a considered recommendation to keep the 940, I'll expect to receive a proposal from WKE/WHP and company, and a JCN/DRB o.k. as to the fund juggling required to balance our accounts.

```
':5262', 01/08/71 1242:13 MEJ ; .DPR=1; :JRNLA, 01/08/71 1140:42 DCE ;
.HED="                                                    08JAN71 DCE 5262

Memo: Considerations regarding extending 940 lease ";
|    .    |    .    2    .    3    .    4    .    5    .    6    .    7
.SNF=72; .MCH=65; .SNB=0; .DLS=1; .SCR=2; .RTJ=0; .PGN=0; .COD[21B]=114B;
.DIR=0;       .DPR=0;
```

. 08JAN71 DCE 5263

Memo: ICON, and NCP TENEX Implementation

It is becoming worrisome that BBN may not be able to implement the Network Control Program (NCP) for TENEX in time to meet our schedule for offering on-line NIC access. We have two basic alternatives: waiting until they (or another TENEX site) develops the NCP, or implementing it ourselves. My current inclination, as explained below, would be to wait and to make it clear that we expect BBN to deliver a TENEX NCP -- until, of course, there might be issued a formal and direct indication that such was no longer intended/expected by the BBN/ARPA pair, or until other ARC needs than those discussed here make it of very high alue for us to have an NCP. 1

Rather than sweat about the NCP problem, I would put our energies into developing the ICON System -- which is my new name for an Imp COmmunication Network. ICON would serve terminals tied directly to IMPs, using a standard Honeywell-516 Typewriter interface. The terminal would be located at the site's NIC Reference and Communication (R&C) Station, and its first-priority site use is for R&C (NIC) business. Initially, one terminal per IMP can likely be served using the current Teletype interface -- BBN (Frank Heart) seems willing to consider sharing that interface's use with their occasional maintenance-Teletype use. 2

For more detail on what I'm thinking about relative to ICON, refer to my "NETWX Memo" (4790,), which discusses in some detail various considerations and possibilites for making Network-communication use of the IMP typewriter ports. There are several configurations of software modules that could support such a communications system -- the "ICON configuration" that I currently want to push ahead on is outlined briefly in (4790,3a4) as "Host-Supported Central System." 2a

Briefly, ICON would consist of a processor, running in TENEX, that controls the IMP typewriters when they are used in the ICON mode (as opposed to "normal," IMP-DDT operation). I assume that we could develop the initial version of ICON to work with only a very rudimenary (and easily implementd) "NCP" interface to the IMP, and that we could thus provide very effective communication, reference, and documentation support to the R&C Stations without the full-blown TENEX NCP. 2b

Consider the following: 3

(ICON would have considerable value, even if every site had

its IMP-interface hardeware and NCP working. See (4822,4) for a discussion its value in this regard.) 3a

With an ICON system, R&C Service for the sites would be entirely independent of their interface hardware, their NCP, and their host's problems with operating systems, system loading, etc. 3b

Since it is expected that the various sites will be quite slow in developing reliable Network access through their NCP's, an early implementation of ICON would provide a very much enhanced R&C service to the network, and likely provide a good stimulus toward increased interest in Network activity and toward getting the sites on the air with NCPs. 3c

When Person A at Site A wants to communicate with Person B at Site B, he (probably they) wouldn't want to be blockd by the fact that at one or both sites there happened to be relatively low value placed upon having a working NCP up and having log-on capacity available for communication terminals. 3d

Assuming that ICON is a feasible system concept, and that we decide that that's the way we should support a Network Reference and Communication System, then it would seem we should bypass TENEX NCP and go directly for ICON. ICON alone would be much more effective for on-line NIC service (at least until next summer) than would be a Reference and Communiion system dependent upon user terminals being linked to NIC via host-NCP chains. 4

```
':5263', 01/08/71 1240:06 MEJ ; .DPR=1; :JRNLB, 01/08/71 1209:47 DCE ;
.HED="                                                    08JAN71 DCE 5263

Memo: ICON, and NCP TENEX Implementation ";
|    .    |    .    2    .    3    .    4    .    5    .    6    .    7
.SNF=72; .MCH=65; .SNB=0; .DLS=1; .SCR=2; .RTJ=0; .PGN=0; .COD[21B]=114B;
.DIR=0;       .DPR=0;
```

Preparatory Notes for Roberts/Crocker Visit of Wed 6 Jan 71

Basic "day plan". 1

Expect to follow Larry's needs and interests in reviewing our activities or in his describing ARPA's plans and desires. We will be prepared with materials etc. for describing and demonstrating relevant history, status, plans and computer processes. 1a

Have an outline of topic areas prepared (cf. 2 below) as a guide to our activity, and as a means for organizing our reference materials and the people who can present and discuss them. 1b

Conduct meetings in Cave; assume that Bill English, Jim Norton, and Dick Watson are involved for most of the time; others brought in when relevant; Dave Brown welcome to sit in on as much as he wants. 1c

Break for a group lunch, in the lab, with brought-in food. Either during, or after, see if Larry is willing to have an informal discussion wth the group about Network activity and plans, ARPA's general plans, etc. 1d

SRI people who may actively become involved in the day's discussion are listed in Branch 3 below. A bit of descriptive text is inserted for orienteation (of all parties). 1e

Agenda possibilities 2

NIC Plans
see(english,plnotes,sched: ebbtznD)). 2a

Review of general NIC plan 2a1

Reference to past plans: 2a1a

1969 proposal, covering current contract period (5229,). 2a1a1

"Relevancy memo" submitted t ARPA on 7 Dec 69, in support of the proposal (5220,). 2a1a2

Basic items, from proposal 2a1b

Prepare set of basic services: 2a1b1

Collection 2a1b1a

Preparatory Notes for Roberts/Crocker Visit of Wed 6 Jan 71

TODAS 2a1b1b

GODAS 2a1b1c

Changes 2a1c

PDP-10 transfer caused early manpower drain toward increasing service-system capacity and implementation flexibility. 2a1c1

Desire to get some activity going motivated the "Network Dialogue System" (4792,). 2a1c2

NIC Status Now 2a2

Network Dialogue System beginning to work 2a2a

Agents communicating, beginning to put through some memos and messages. 2a2a1

Collection: 2a2b

Physically have over 5,000 items in ARC's XDOC Collection (Bibliographic system), 2a2b1

NIC Collection will be a sub-set of the XDOC Collection. 2a2b2

Estimate that 500 to 800 of the XDOC Item would eventually prove relevant to the NIC clientele, 2a2b3

Currently have about 140 items in the NIC Collection (about 120 mailed to sites). 2a2b4

Have isolated about 200 more XDOC items that seem relevant now -- these are planned for inclusion soon in the NIC "Subcollection" 2a2b5

Providing for steady addition from messages, memos, survey summaries, formal Network documentation, etc. 2a2b6

Catalog 2a2c

Developed common conventions for catalog entries over entire collection. 2a2c1

On-line entry formats being converted from old form. 2a2c2

Preparatory Notes for Roberts/Crocker Visit of Wed 6 Jan 71

NIC and Journal collections have their catalog formats all converted. All new entries going in with new form. 2a2c3

Each entry is stored now as one long string, within an NLS statement, with special character pair delimiters for separating and identifying the different data elements. 2a2c4

With the new features offered in L10, we will later be able relativly easily to evolve more efficient data storage forms. 2a2c4a

Catalog-Management Processes and Procedures 2a2d

Hard-copy "shelf-list" and "index" generation. 2a2e

Rudimentary query system 2a2f

TODAS 2a2g

Output Processor 2a2h

NIC Baseline see(see(english,plnotes,2g: gebtznD)). 2a3

NIC Staffing 2a4

Miscellaneous 2a5

Datatype machine 2a5a

Seems to be a very intriguing way to produce machine-input documentation (on a device familiar to most typists, with readable record, easy conventions, little training, etc.), 2a5a1

Would seem valuable for us to develop a deferrd-execution system to handle inputfrom Selectric/Datatype, and provide documentation support to any of these systems in the Network. 2a5a2

Dialogue Support System (DSS) 2b

The Journal 2b1

Message System 2b2

Preparatory Notes for Roberts/Crocker Visit of Wed 6 Jan 71

Preparatory Notes for Roberts/Crocker Visit of Wed 6 Jan 71

2g1

People involved: 3

Larry Roberts 3a

Steve Crocker 3b

Currently at UCLA where he has been heavily involved in the Network activity; headed the Ad Hoc Working Group on "Network-technology" coordinator, and general stimulator of Network activity. 3b1

Doug Engelbart 3c

Jim Norton 3d

Background in business administration (Stanford); many years in SRI's technical administration; joined ARC in June 69 and has been pushing our management-systems development. (Developed our Baseline-Record system, for instance) 3d1

Shifted emphasis recently toward heavy involvement in NIC developmnt 3d2

Responsble for maintaining ARC-Budget records 3d3

Planned to be heavily involved in setting up NIC operational structure. 3d4

Jeanne North 3e

Professional librarian support for NIC, heavily involved (since arrival in August) in development of catalog format, procedures for clerical support, liaison with R&C Station Agents, 3e1

Dick Watson 3f

To join ARC on Feb 1, slated to take over management of NIC development. 3f1

PhD in Computer Science and EE; on staff at Stanford briefly; been with Shell Development Co. for five years; became head of their 15-man computer-science group; authored recently published (McGraw Hill) book on

time-sharing systems; Shell moved all their computer-systems activity to Houston and he didn't want to go. 3f2

Walt Bass 3g

NIC Software 3g1

Bill Duvall 3h

Chief pusher of ARC's Dialogue Support System; has prime responsibility for design of conjoint (DSS/NIC) file-management and retrieval-processor architecturee. 3h1

The "Subject" of our remote-worker experiment. Depending upon IMLAC over 2000-baud line, developing the IMLAC software toward full NLS power (to yield a easily copied prototype for quickly giving CRT/NLS power to remote users over te Network).. 3h2

Bill English 3i

Bruce Parsley 3j

Output Processor (GODAS) 3j1

Bill Paxton 3k

Languages, architecture 3k1

Charles Irby 3l

User Features 3l1

Jim Fadiman 3m

Psychologist, management consultant; been involved with us for a year and a half, helping us work on the organizational development for our new team-working modes. 3m1

Dave Brown 3n

Manager of Computer Science Laboratory, in which ARC is organizationally located (also supervises AI Group) 3n1

```
':5264', 01/12/71 0908:08 MEJ ; .DPR=1; :JRNLP5264, 01/12/71 0819:51 DCE ;
.HED="                                                  12JAN71 DCE 5264

Preparatory Notes for Roberts/Crocker Visit of Wed 6 Jan 71";
|    .    |    .    2    .    3    .    4    .    5    .    6    .    7
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.DIR=0;        .DPR=0;
```

Summary Notes from Roberts/Crocker Visit of Wed 6 Jan 71

SUMMARY: This memo summarizes major points of the day's meeting. Some associated memos contain other material related to the visit: 1

(5264,) contains material that I prepared previously as a guide for reviewing ARC, NIC and Network activities relative to Larry's expected needs. 1a

Topic headings were: 1a1

Basic "day plan". 1a1a

Agenda Possibilities 1a1b

People involved: 1a1c

A copy of this material was provided for each major participant; Larry and Steve Crocker each took a copy home. 1a2

(5266,) contains a summary of Larry's comments about his Network plans, and (5267,) contains discussion notes on a graphic, hard-copy transmission and printout system that we agreed to study. 1b

Summary notes about the meeting: 2

Larry had called several weeks ago to set up the visit. He seemed concerned with NIC progress, and with the "entanglement" of NIC activities and people with "the rest of ARC's pursuits." One specific statement was something like, "What about getting a manager explicitly for the NIC project?" 2a

Because Steve Crocker's activities and plans seemed closely related to our topics, I suggested that we include him in the meeting (which was done). 2a1

Roberts and Crocker arrived a little after 10 a.m., and left a litte after 1 p.m. Most of meeting was in the Cave, with DCE, WKE, JCN, Dave Brown and Dick Watson present. Lunch was a whole-group affair (sandwiches, salads, soft drinks were served buffet, all of us distributed in a sort of circle, close enough to talk across. Larry spent about 15 minutes addressing the group, answering questions -- see (5266,). 2b

We first discussed his review needs, and divided them into three main topics: NIC status and plans, ARC's overall status

and plans (including budget breakdowns), and our experience in using Utah's PDP-10 over the Network. 2c

The budget interest seemed to stem from ARPA's wanting to know how we were apportioning our resources between NET/NIC support and "ARC Research." We couldn't show him such a division -- we could only point out that a great deal of our work in DSS, "Remote Workstation", etc., would be directly mappable into NIC services when we had them working, and that there were really a relatively small proportion of our activities that weren't directly supportive of the NET/NIC work. 2c1

Our having arranged for Dick Watson to take over the management of NIC development apparenty met Larry's concern about that matter very well. See(2a) above. 2c2

Otherwise, NIC and ARC plans seemed satisfactory. 2c3

We brought up the topic of a central, high-quality COM publication service for the Network, pointing out: how it would complement the draft-copy graphic output devices they wanted to distribute about the Network; the importance we held such a service to be for NIC; and how much it would improve ARC's graphic-portrayal development to have our local hard copy be derived by te same "publication" formatter and portrayal generator (via a Princeton storage scan coverter onto either a regular 875-line TV monitor at an NLS work station, or through such as LDX to page copy). 2d

He asked for a quick summary estimate to be forwarded to him by Friday 8 Jan so that he could consider it in his budget review. 2d1

We discussed the question of ARPA's providing a standard graphic printer at each site, so that graphic material could be transmitted about the Network. (5267,) summarizes this discussion -- we agreed to spend about a man month studying the problem and producing a recommendation. 2e

```
':5265', 01/12/71 0923:53 MEJ ; .DPR=1; :JRNLP5265, 01/12/71 0844:59 DCE ;
.HED="                                                    12JAN71 DCE 5265

Summary Notes from Roberts/Crocker Visit of Wed 6 Jan 71";
|    .    |    .    2    .    3    .    4    .    5    .    6    .    7
.SNF=72; .MCH=65; .SNB=0; .DLS=1; .SCR=2; .RTJ=0; .PGN=0; .COD[21B]=114B;
.DIR=0;        .DPR=0;
```

Log: Comments about ARPA Network by Larry Roberts on 6 Jan 71

Note: The following were from notes I made while Larry was addressing a meeting of ARC staff at lunchtime, during his visit here on 6 Jan. See (5265,) for general meeting-summry notes. 1

NSF likely to get onto the Network, with about five terminals, in late 1971. 2

Universities are interested, particularly because the Network can allow them to share some very expensive but lightly loaded special resources. 3

Expects something like 21 nodes by mid 1972. 4

Sometime about the end of 1971, likely ready to open the Net to any government agency willing to pay their costs. 5

Exploring the possiblities for a contractor (e.g. the telephone company) taking over and managing the Network -- perhaps by 1972. 6

Like, there could grow to be up to 40 to 60 nodes. 6a

Perhaps some Federal agency might want to take it over as a communication system. 6b

Possibly let some utility organization link into the Network just to sell service. 7

He envisions having as service centers UCSB, ILLIAC, and NIC -- perhaps others, before then. 7a

For ARPA, savings by not hving to duplicate resources at the different research centers will easily offset the costs of running the Network, even with limited use. 8

For the current 11 sites, he guessed that it would be summer before they all have their NCP software working. 9

Network operating costs for the next-generation IMP-phonelink arrangement: 10

About $3K/month to have an IMP connected into the Net. 10a

Current IMP is about $6K/month. 10a1

About $.25/megabit for transmission. 10b

If fully loaded, transmission would be more like

Log: Comments about ARPA Network by Larry Roberts on 6 Jan 71

$.08/megabit, but he was assuming a "peak-loading factor" of about 3. 10b1

This is for a network with from 40 to 110 nodes (I think this is what he said). 10c

They plan to use 10 kilobaud links (rather than the current 50 kilobaud ones) to some of the more lightly-used nodes. 11

Planning on a couple of transoceanic links. 12

One that will go through England an on to Norway, with several possible nodes set up in England. 12a

Trying to negotiate a link to Hawaii. (About Australia: overwhelmingly far.) 12b

Plan is for the trillion-bit laser store to begin operation in March 72 (wherever the ILLIAC IV will be). 13

Several companies now considering buying IMPs and setting up their own networks. Also, some consideration going on of companies sharing costs on the current Network -- but this couldn't be done if ARPA retains "ownership" because of governmnent policies. 14

```
':5266', 0|/|2/7| 0959:03 MEJ ; .DPR=|; :JRNLP5266, 0|/||/7| |22|:59 DCE ;
.HED="                                                    ||JAN7| DCE 5266

Log: Comments about ARPA Network by Larry Roberts on 6 Jan 7|";
|    .    |    .    2    .    3    .    4    .    5    .    6    .    7
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.DIR=0;          .DPR=0;
```

Roberts and ARC: Graphic Communication and Printing via Network

During Larry Robert's 6 Jan visit, see(5265,), he and Steve Crocker expressed considerable interest in some means for handling full-graphics portrayals -- transmitting through the Network and printing onto page copy at any site. 1

Larry is thinking of some solution that would cost on the order of $10K per site, produce page prints at least acceptable for working drafts. Seemed to accept the possibility of a medium-quality character generator. 1a

Discussion soon bogged down with the familiar set of conflicting considerations -- to avoid duplicating the picture drawing equipment, need send fully made picture; to have reasonable cost must use either a display-copier with built-in character set (e.g. Tektronix), or a scan-line printer such as Gould-Clevite or Xerox LDX -- but he LDX cannot print a scan line assynchronously and thus needs prohibitive local bit storage if the whole raster needs be transmitted. G-C can handle each scan line assynchronously, and is reasonably low priced. But now solution seems t offer high quality and low cost. 1b

It appeared that someone would have to make a better study, and Larry asked us to do it. WE AGREED TO INVEST ON THE ORDER OF A MAN MONTH, in collaborative communicaton with Steve Crocker, and to forward to ARPA a recommendation as to how to proceed from there. 2

Dick Watson and I had a strong feeling that the type of solution offered by immediate rental of Tektronix display-copier terminals would be better than to take a year to engineer and develop some "more elegant" solution. The Tektronix could support a very wide range of experimentation, and would generally provide completely adequate working copy of any graphic material. Getting the experience in using the Tektronix would be very valuable in converging upon the requirements for a next generation that could be more elegant. 2a

```
':5267', 01/12/71 1056:28 MEJ ; .DPR=1; :JRNLP5267, 01/11/71 1222:39 DCE ;
.HED="                                                    11JAN71 DCE 5267

Roberts and ARC: Graphic Communication and Printing via Network";
|    .    |    .    2    .    3    .    4    .    5    .    6    .    7
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.DIR=0;       .DPR=0;
```

Phone Log: Call DCE to Dr. George Dodd, GM, re.(5614)

This records my call to Dr.George Dodd, Computer Technology, General Motors Technology Center, Warren, Michigan, phone (313) 575-3008 (direct line): 1

I wanted to see if he had gotten my letter, (5614,). 1a

December 7 letter from me (5614,) had wrong name (Dobbs) -- he hasn't received it. 2

He'll contact Pete Fisher to borrow our ASIS film. 3

If Pete has sent it back to us, George will drop us a note, to arrange for a loan of his own. 4

He invited me to spend a day at GM sometime. He'd arrange meetings with their system-development types. 5

```
':5268', 01/12/71 1134:44 MEJ ; .DPR=1; :JRNLP5268, 01/11/71 1245:14 DCE ;
.DPR=1;  .DPR=0;
```

Letter: D.C. Engelbart to George Dodd, GM Research Laboratory

Dr. George Dodd
Computer Technology,
General Motors Technology Center
Warren, Michigan 1

Dear George: 2

(Note: This letter as originally sent (7 DEC 70) unfortunately had your name wrong -- ARC-file (5614,). Despite our subsequent phone talk -- ARC-file (5668,) -- I thought that you might want to see the original material. DCE) 3

When we talked at FJCC, I told you about a movie that we had made, and which you might well find worth seeing. When I inquired about availabiliy here of a copy to send to you, I found that one has just been sent to a Pete Fisher, 6-217 GM Bldg, Detroit. It would save fuss and overhead and such if you could give him a call, and get it from him after he is through. 4

The movie is on three 33-minute reels of 16-mm black-and-white, with an optical sound track. Besides the content, you might well be interested in seeing how we used TV-video techniques for giving a presentation and making a movie -- this approach might be useful for you in giving presentations, or making educational or promotional movies of your on-line techniques. 5

The movie is an unedited record of an "on-line presentation" that our group made for the 1969 Annual Meeting of the American Socieity for Information Sciences (ASIS), in San Francisco. We leased two microwave links to the City from our lab, and used phone lines to connect console control and intercom. 5a

You might (possibly) remember that we use 875-line video to pipe our displays out to our consoles (in our lab); we have also acquired some standard equipment for switching, mixing, and frame-dividing the video. For our presentation, we borrowed an Eidophor video projector, which is an amazing device that projected an easily viewable, movie-bright image for our near-800 person audience. 5b

I sat at the front of the auditorium, at one of our working consoles. A PA sytem projected my voice, and the Eidophor projected my images -- images of my face, of my hands at the controls, and of the computer-generated displays I was causing -- as produced by a number of TV cameras and switced, mixed,

Letter: D.C. Engelbart to George Dodd, GM Research Laboratory

split, etc. by Bill English at a control station at the back of the auditorium. We even switched in live camera shots of our lab in Menlo Park, and of people at consoles there who gave presentaions to the audience on special aspects of our work. While they talked, various camera shots of them were projected for the audience to give the speakers a real "presence" in the auditorium, and these shots were intermixed and/or overlaid with the computer-generated images they were controlling as part of their presentation. 5c

Since the full prsentation was designed both to describe our work (goals, techniques, and the way we apply these techniques in our work) as well as to demonstrate how we do things, the movie record is the best thing we've found for communicating what is going on here. I truly hope that you can find time to see it. 6

It would seem to me very worthwhile if somehow the things that both of our groups are doing can begin to benefit from some direct dialogue betwen us. Toward this end, I am sending copies of our latest reports, and I will seriously try to work in a visit to your labs at some mutually convenient (or reasonably convenient) time. 7

My very best regards,

Douglas C. Engelbart, Manager
Augmentation Research Center
Stanford Research Institute
333 Ravenswood Avenue
Menlo Park, California 94025 8

```
':5269', 01/12/71 12|7:35 MEJ ; .DPR=1; :JRNLP5269, 01/11/71 13|7:39 DCE ;
.DPR=1; :JRNLP5614, 12/07/70 10|0:10 DCE ;   .HED="
||JAN71| DCE 5269

Letter: D.C. Engelbart to George Dodd, GM Research Laboratory ";
|   .   |   .   2   .   3   .   4   .   5   .   6   .   7
.SNF=72; .MCH=65; .SNB=0; .DLS=1; .SCR=2; .RTJ=0; .PGN=0; .COD[21B]=114B;
.DIR=0;      .DPR=0;  .DPR=0;
```

Design Notes: Set-Manipulation Query System

INTRODUCTION 1

These notes deal with a first stage of set-manipulation conventions and proceses, aimed expressly at doing querying over the ARC Catalog, or its various sub-collections (such as for NIC and Journal). 1a

I envision these features, and their naturally evolved improvements, as providing all of the query capability that our next year of NIC operation would reasonably need. I'm not limiting our hopes to this; rather I consider that these features will get us into a comfortable position with respect to our NIC obligations. 1a1

After reaching the stage outlined below, I expect our subsequent push on set-manipulation and sophisticated querying to be guided mostly by needs in development of our Dialogue Support System -- for effectively analyzing our Dialogue Records and integrating relevant passages into updated formulations of needs, possibilities, plans, designs, explanations, or etc. 1a2

A first set-manipulation sytem, aimed explicitly at supporting query operations over our Master Catalogs (i.e. over the items represented by our Master-Catalog entries), may be restricted to sets whose elements are these Master-Collection items, as described and represented by their entries in the Master Catalog. 1b

In this case, a list of Accession Numbers is an adequate reprsentation of a set, and is something that could be handled relatively easily by a first, simple set-manipulaton system (as sketched below). 1b1

In due time (like next fall?) we may well have set representations and set-manipulation operations that can deal with sets whose elements may be NLS entities of any type -- e.g. a text character, a text string, a line in a drawing, a label on a drawing, a branch of a file, a whole file, another set, etc. 1c

To provide for elements that are other sets would seem to be a most valuable next step beyond handling catalog-citation elements. 1c1

I am hoping that a Query-Set system of the general form

described below could be implemented this spring, as one of the early new things added to NLS under TENEX. 1d

SET REPRESENTATION, AS CONTAINED IN AN NLS STATEMENT: 2

Syntax: 2a

(SETNAME) COMMENT TEXT * GENPROCESS DATA ** GENERATION SPECIFICATION *** SET REPRESENTATION 2a1

Example: 2b

(SET1) Items culled from the time-sharing collectons of Dave Harris and Tom Cheatham * 8 71JAN05 1507;22 ** ((Cheatham, DOCFILE, TSSYS) UNION (Harris, STUDYNOTES, TSSBIBLIO)) IF (AUTHOR NOT Smythe AND DATE SINCE 68) *** 4368 4582 4593 4657 4822 4823 4826 5013 2b1

A user can apply to such a statement an NLS operation (eg. Execute Set Generation"). The processor will: perform the operations specified in GENERATION SPECIFICATION, to generate a new set; insert (replace) the SET REPRESENTATION data; and insert (update) the GENPROCESS DATA. 2b2

SETNAME :=: LETTER $(LETTER / DIGIT) ; the name by which the set can be referenced -- a standard NLS NAME, referenceable by a standard NLS LINK. 2c

COMMENT TEXT :=: $NOT("*") ; for comments, general description of the set, etc. 2d

GENPROCESS DATA :=: SETNUM SETDATE ; e.g. 18 71AUG15 1421:15 -- representing information inserted (updated) automatically by the system at the time the set was generated, 2e

SETNUM :=: 1$D ; representing the number of elements in the set. 2e1

SETDATE :=: DDLLLDD DDDD:DD ; representing the date and time that the NLS set-generation operation was last successfully executed on this statement -- i.e. when the associated set was generated. 2e2

GENERATION SPECIFICATION :=: An expression consisting of set operations (inclusion, exclusion and intersection) applied to sets that are either already formed (given by name) or that

are defined by content-analysis tests on the catalog entries of designated sets. 2f

Later refinements should enable these tests to be applied over any computer data linked to the catalog entries -- e.g. abstracts, annotative notes, or full content of a catalogued computer file that is accessible to the system. We also expect to make similar search and test operations that begin with the catalog entries of items referenced by a given item, or that contain references to a given item -- which opens up whole chains of indirect linkage to catalog entries and associated computer-held data. 2f1

SET REPRESENTATION :=: $ANUM ; where ANUM is the unique accession number of an item in our Collection. 2g

Initially, these ANUMs will be ordered according to increasing numerical value. Later, we may try to accommodate arbitrary ordering. 2g1

Also, in the initial implementation of the "Set-Representation Statement", the ANUMS will likely be listed as a string of numbers separated by spacing characters -- they will be part of the text of the statement. 2g2

Later, it is likely that other, internal representations will be coded as part of the node data. 2g2a

Discussion: 2h

SET-LISTING BRANCH 3

Syntax of Branch Source Statement: 3a

((LISTNAME)/.EMPTY) ANYTEXT (LISTLINK) ANYTEXT (FORMLINK) ANYTEXT ** GENPROCESS DATA 3a1

LISTNAME :=: LETTER $(LETTER/DIGIT) ; Standard NLS NAME, used however desired for general reference. 3a2

ANYTEXT :=: $NOT"(" ; arbitrary text string, user's option. 3a3

LISTLINK :=: Standard NLS Link, to the Set Representation Statement whose set elements (Catalog Entries) are to be

formatted and listed as a plex beneath this statement. 3a4

FORMLINK :=: Standard NLS Link, to the Format-Program Branch to be used in formatting the set listing. 3a5

GENPROCESS DATA :=: SETNUM SETDATE -- FORMDATE:; allows checking to see if this list has had subsequent deletions, if any of the items has had subsequent editing, or if the list was generated from an old version of the set. 3a6

SETNUM and SETDATE are copied from th corrsponding data elements in the SET-REPRESENTATION Statemnt of the Set that is to be listed, 3a6a

SETNUM records the number of items to be listed -- allows checking to see if this list has had subsequent deletions. 3a6a1

SETDATE records the "date version" of the set that was listed -- one can check to see if the listing is of an old, or of the updated, version of the set. 3a6a2

FORMDATE records the time when this set listing was done (last) -- allows checking to see if any of the items has had subsequent editing. 3a6b

Dicussion: 3b

Execution of this Source Statementof a SET-LISTING BRANCH (by an NLS operation e.g. "Execute Set Listing"), deletes any existing sub-plex, and inserts a new sub-plex which is a listing of the catalog citations of the prescribed set with formatting as prescribed in the designated Form Program. The FORMDATE is updated. 3b1

This allows a user to list the elements of a set in any way he wants, using any of a library of standard formatting processes, or one of his own. 3b2

The listing is inserted in an NLS file, even for casual inspection. This way, one can keep such listings around as long as desired, returning to inspect them when useful, and easily deleting them later. 3b3

SET LISTING-FORM PROGRAMS 4

Syntax: 4a

Design Notes: Set-Manipulation Query System

(FORMNAME) COMMENT TEXT 4a1

FORMATPROGRAM 4a1a

DIscussion: 4b

The FORMATPROGRAM is a source-code plex, using any of the L10 constructs, and any of the NLS Procedures 4b1

The Program may refer to other such programs, e.g. in case a catalog entry (set element being listed) passes a certain content test it is to be formatted by that program. 4b2

Such reference would be made via an NLS link, using the FORMNAME of that other formtting program. 4b2a

Besides specifying the format for listing the catalog entries, it can specify the sorting keys for producing multiply sorted ordering of the items in the listing. 4b3

```
':5273', 01/12/71 1238:45 MEJ ; .DPR=1; :JRNLP5273, 01/11/71 1458:55 DCE ;
.HED="                                                    11JAN71 DCE 5273

Design Notes: Set-Manipulation Query System";  Distribution:  WSD, CHI,
WHP, WKE, JCN, WLB.
|    .    |    .    2    .    3    .    4    .    5    .    6    .    7
.SNF=72; .MCH=65; .SNB=0; .DLS=1; .SCR=2; .RTJ=0; .PGN=0; .COD[21B]=114B;
.DIR=0;       .DPR=0;
```

Text Macros for L10, NLS

Text macros have been widely used in assemblers and compilers for some time. 1

In higher level languages, there availibility and use often serves a number of purposes in programming: 2

Flexibility 2a

When constants, flags, logical tests are made via macroes, it becomes very easy to change baasic values in a program. 2a1

Example: suppose that "Define .ID = .SR '# Defines a text string .ID with .SR, and wherever .ID is used, .SR is substituted. 2a2

In TODAS Print (TSP10), we currently want to ignore markers, so: 2a2a

```
Define markerflag = FALSE#;                    2a2a1
.                                              2a2a2
.                                              2a2a3
.                                              2a2a4
If markerflag Then ...                         2a2a5
```

Now we wish to activate the marker code: 2a2b

```
Define markerflag = tda.davspec.vsmkrf#        2a2b1
```

The accessing code remains unchanged 2a2b2

Now assume that in another version (version 2, say) the markerflag is in a different field. 2a2c

```
Define markerflag = IF tda.version1 THEN
tda.davspec.vsmkrf ELSE tda.davspec.vsmkrf2#    2a2c1
```

The accessing statements remain unchanged. 2a2c2

Readability 2b

It is desirable to have programs be as readable as possible. 2b1

Text Macros for L10, NLS

To this end, the more symbolic the code, the better. 2b2

As illustrated above, text macroes may be used extensively in mmking programs symbolic. 2b3

Convenience 2c

This is the obvious asset of macros. They allow a user to type aa macro cal instead of a long repetitive phrase. 2c1

It seems reasonable to aassume that macros have applicibility in the general comain of text editing and viewing. 3

It therefore seems reasonabel to search for a macro facility which is not only available to L10, but to the general NLS user. 3a

There are many levels of power in different macro facility. 4

It is one of those subjects which, the more one thinks about it, the more features he can devise, until it is difficult to concieve of implementing a version with less power than the ultimate. 4a

With our busy schedule in the near future, we should be cognizant that even a simple macro faacility is immensly powerful, and may be more desirable (because of resource considerations) than a more powerful version 4b

In specifying a macro facility to be implemented on the 10 (at least initially), we should consider some of the following: 5

It seems as though the logical place for a macro facility in NLS is the portrayal generator. 5a

This acknowledges it's similarity to A/F type of things, Output Processor controls, etc. 5a1

One of the prime features of macros is that they make programs (and possibley text in general) more readable. 5b

As such, the macro call syntax should be as transparant as possible. 5b1

A facility should be provided whereby the definition of a mmacro call may easily be seen and changed. 5c

Text Macros for L1O, NLS

This should imply that a macro definition should be representable by aan NLS statement. 5c1

It would seem to be desirable to allow macros to be associated with any file, not just the one in which they are used. 5d

There needs, hoever, to be some method aof selection of the set to be used. 5d1

We should probably at least consider allowing: 5e

(1) maacros with arguments 5e1

(2) string macros 5e2

There was a suggestion that we implement macros ALA Strache sometime back. That documnt should be resurrected and considered. 5f

':5274', 01/15/71 1058:54 MEJ ; .DPR=1; :JRNL1, 01/13/71 1445:37 WSD ; TO DCE WKE BLP WHP CHI;

This memo briefly describes somme thoughts one the utility, feasibility, and implementation of 'text Macros'.; .DPR=0;

Log: 13 Jan Visit from Scroggie Wiley, SRI Washington Office

Visit from Gordon (Scroggie) Wiley, SRI Washington Office 1

Executive Director, Program Development, SRI, 1611 N. Kent Street, Rosslyn Plaza, Arlington, Va. 22209, (703) 524-2053 1a

Situation: Navy Bu Pers acquaintance of SW's, Capt. Geo Britner, Chief of Personnel Research DIvision (SW met at Monterey) 2

GB introduced SW to R.C. Mattingly (civilian), heads a Branch on Man-Machine SYstems Research (with whom SW has spoken on the phone). 2a

They dIscussed what ideas SW could communicate re ARC's experiences: decided that SW would try taking more ingormation back to RCM, communicating next week. From that, see if any of his interests warranted further communication. 2b

I described in some detail the strategic goals of ARC, into SYDIA. Said that our interest would be in getting such contacts intersted in cooperative SYDIA development. Showed SW the notions of Integration Center, SYDIA, RINS, etc. 3

Best that we could offer (with respect to inofrming Mattingly) would be: 4

Make ASIS Movie available, for Mattingly. 4a

Either through SW & Washington Office, or directly to Mattingly. 4a1

Provide biblio sheet, and a few reports. 4b

After that, if M is still interested, best bet is a visit here to our lab. Can't really do much more by my personally visiting him. 4c

Our interest, in case they are interested in us: 5

We'd like best to try enlisting them, along wth other such agencies, as participants in a joing "SYDIA-like" venture. (SYDIA is our acronym for Systems Developers' Interface Activity) 5a

i think i will go to Mattingly's office and discuss with him our capabilities 5b

13JAN71 DCE 5275

Log: 13 Jan Visit from Scroggie Wiley, SRI Washington Office

SW will take biblio, FJCC, RADC 70, and NASA 70 with him: and call next week to arrange for ASIS movie. 6

```
':5275', 01/18/71 0917:54 MEJ ; .DPR=1; :JRNLA, 01/13/71 1540:57 DCE ;
.HED="                                                    13JAN71  DCE 5275

Log: 13 Jan Visit from Scroggie Wiley, SRI Washington Office ";
|    .    |    .    2    .    3    .    4    .    5    .    6    .    7
.SNF=72; .MCH=65; .SNB=0; .DLS=1; .SCR=2; .RTJ=0; .PGN=0; .COD[21B]=114B;
.DIR=0;       .DPR=0;
```

ARC JOURNAL CATALOG ** by Number ** 5 January 1971

4792 DCE 10/01/70 Setting Up a Network Dialogue System
Source: :4792 Time: 1441:12 1

4800 WSD 08/02/70 Comments on NETWX THINKPIECE(see--NIC,5555,)
Source: 2

4801 WSD 08/03/70 Initial Journal System
Source: Memo from WSD 3

4802 UNASSIGNED 4

4803 DCE 08/03/70 Initial Journal System (Edited version of 4801, from DCE to WSD)
Source: :JRNL1 Time: 1946:01 5

4804 WSD 08/04/70 Initial Journal System (Version of 4801 and 4803, re-edited by WSD)
Source: :JRNL2 Time: 1016:47 6

4805 WSD 08/04/70 Memo Concerning Initial Journal (Memo to DCE from WSD)
Source: :JMEMO Time: 1135:09 7

4806 WSD 07/17/70 Brief Description of Interim Index/Catalogue Generation Scheme
Source: :INTIR Time: 0900:43 8

4807 WSD 08/05/70 Convention for handling bad files submitted to Journal
Source: :BADJRNLFILES Time: 2335:33 9

4808 WSD 08/05/70 PRELIMINARY SPECIFICATION OF MAIL SYSTEM WITH AUTOMATIC JOURNAL ENTRY
Source: :MAILSPEC Time: 1840:46 10

4809 HAL 08/05/70 FUNCTIONAL SPECIFICATION FOR PRIMARY TAPE ARCHIVE SYSTEM
Source: :JRNL1 Time: 2340:56 11

4810 MAIL 08/13/70 MAIL FILE
Source: :4810 Time: 1016:34 12

4811 WSD 08/12/70 USER DESCRIPTION OF MAIL SYSTEM WITH AUTOMATIC
JOURNAL ENTRY
Source: :MAILMEMO Time: 1629:53 13

4812 WKE 08/11/70 MEMO ON 940 SCHEDULING; TO ARC FROM WKE
Source: Time: 14

4813 MAIL 08/13/70 MAIL FILE
Source: :MAIL Time: 2319:21 15

4814 MAIL 08/14/70 MAIL FILE
Source: :MAIL Time: 1727:59 16

4815 MAIL 08/17/70 MAIL FILE
Source: :MAIL Time: 1521:56 17

4816 JCN 08/14/70 ARC CONTRACTS: STATEMENTS OF WORK
Source: :STATE Time: 1200:24 18

4817 MAIL 08/18/70 MAIL FILE
Source: :MAIL Time: 2011:25 19

4818 WSD 08/11/70 Conversation between WSD and KEV
Source: :FDPROG Time: 1807:09 20

4819 MAIL 08/19/70 MAIL FILE
Source: :MAIL Time: 2111:56 21

4820 MGC 08/18/70 Notes from WSD/JCN meeting 8/17/70 re: Journal Entry procedures
Source: :TEMP Time: 1619:18 22

4821 MAIL 08/23/70 MAIL FILE
Source: :MAIL Time: 1546:17 23

4822 DCE 08/03/70 NETWX THINKPIECE, D.C. Engelbart 3 Aug 70
NIC 4790
Source: xxx Time: 1228:55 24

4823 DCE 7/29/70 Rough Cost Prediction Transmitted by DCE to ARPA
7/29/70
Source: :COST Time: 1245:15 25

4824 MAIL 08/25/70 MAIL FILE
Source: :MAIL Time: 1008:07 26

4825 HAL 08/24/70 FUNCTIONAL SPECIFICATION FOR PRIMARY TAPE ARCHIVE SYSTEM, CONTINUED
Source: :ARCHI Time: 0926:57 27

4826 JCN 08/21/70 Journal Entry: Clerical Procedures
Source: :4820 Time: 1745:18 28

4827 MAIL 08/25/70 MAIL FILE
Source: :MAIL Time: 2009:38 29

4828 JCN 08/25/70 ARC BASELINE PLANS
Source: :ARC1P Time: 1119:35 30

4829 WKE 08/25/70 PDP-10 Acquisition
Source: :10ACQ Time: 1125:22 31

4830 HAL 08/24/70 FUNCTIONAL SPECIFICATION FOR PRIMARY TAPE ARCHIVE SYSTEM
Source: :ARCHI Time: 0926:57 32

4831 WKE 07/29/70 PLANS FOR THE REMOTE SITE EXPERIMENT
Source: :RMDSP Time: 1420:16 33

4832 WKE 07/10/70 NETWORK ACCESS TO SYSTEM
Source: :NEWAC Time: 0507:58 34

4833 DCE 08/19/70 NOTES ON ARC's RESEARCH INTELLIGENCE SYSTEM (RINS)
Source: :RINS Time: 1137:51 35

4834 JCN 08/25/70 ARC ROLES
Source: :ROLES Time: 1139:02 36

4835 MAIL 08/27/70 MAIL FILE
Source: :MAIL Time: 0932:00 37

4836 WSD 08/26/70 Collector Sorter Flow Charts...Hard copy attached (5 pgs)
Source: :COLSORT--FLOW CHARTS Time: 1158:39 38

4837 WSD 08/26/70 Collector Sorter command syntax
Source: :COLSORT SYNTAX Time: 1215:31 39

4838 WSD 08/26/70 Comments regarding File use at UCSB..re-4935
(xdoc)
Source: FILE COMMENTS Time: 1238:19 40

4839 WSD 08/26/70 Impressions of Early Mail System Use and Suggestions for a Preliminary 'Needs and Possibilities System'
Source: :MAILMEMO Time: 1254:57 41

4840 MAIL 08/27/70 MAIL FILE
Source: :MAIL Time: 2219:48 42

4841 DCE 08/27/70 Notes on phone call from Dave Harris, UCSB
Source: :JRNL1 Time: 1620:50 43

4842 MAIL 09/04/70 MAIL FILE
Source: :MAIL Time: 1059:25 44

4843 WSD 08/27/70 Notes from meeting with HAL, WKE, JCN, DCE, and
WSD on 26AUG70
Source: :MEET NOTES(On Archive System) Time: xxx 45

4844 MAIL 09/04/70 MAIL FILE
Source: :MAIL Time: 1059:25 46

4845 MAIL 09/06/70 MAIL FILE
Source: :MAIL Time: 1506:33 47

4846 MAIL 09/15/70 MAIL FILE
Source: :MAIL Time: 1857:27 48

4847 MGC 09/17/70 Procedure to Enter Text into NLS via Punched
Paper Tape --
With Hard Copy Attachment, 1 page
Source: :PATAE Time: 1418:25 49

4848 UNASSIGNED
50

4849 BLP 08/08/70 /Output Processor/
Source: :OPLAN Time: 1612:05 51

4850 WSD 08/08/70 Loading instructions for Mail system
Source: :MAILOAD Time: 1619:15 52

4851 DCE 09/10/70 Setup of a National Environmental Protection Agency (EPA)
Source: :JRNLA Time: 2236:25 53

4852 DCE 09/11/70 To NIC Pusher and Staff: info from Larry Roberts
Source: :JRNLC Time: 0912:37 54

4853 JCN 09/11/70 ARC BASELINE PLANS ..... 9/9/70 am
Source: :TASKS Time: 0958:30 55

4854 WKE 08/08/70 [no title]
Source: :1OHDW Time: 1528:39 56

4855 WHP 09/10/70 [no title]
Source: :1OSFT Time: 1451:57 57

4856 HAL 08/31/70 [no title]
Source: :ARCHI Time: 1001:37 58

4857 WKE 07/31/70 Plans for Remote Site Experiment
Source: :RMDSP Time: 1122:19 59

4858 WKE 07/10/70 Network Access to System
Source: :NETAC Time: 1214:17 60

4859 JCN 09/11/70 [no title]
Source: :TEAM Time: 0926:33 61

4860 CHI 09/11/70 New NLS features
Source: :NLFEA Time: 0956:57 62

4861 JCN 09/11/70 [no title]
Source: :NICEX Time: 1805:18 63

4862 JCN 09/11/70 ARC Record system development
Source: :RECOR Time: 1028:23 64

4863 JCN 09/10/70 ARC Resource Coordination
Source: :RESOU Time: 0947:58 65

4864 JCN 09/15/70 ARC Role Develoopment
Source: :ROLES Time: 1650:57 66

4865 MAIL 09/25/70 MAIL FILE
Source: :MAIL Time: 1355:56 67

4866 WKE 09/15/70 Bryant Drums - Pro and Con
Source: :DRUMS Time: 1303:05 68

4867 WSD 09/15/70 Notes, Guesses, and Speculations - TENEX File System
Source: :FILENOTE Time: 1438:53 69

4868 ARC 07/12/70 7101 ROME FINAL Report: Sec. I - INTRODUCTION
Source: :ROMEF Time: 1911:18 70

4869 ARC 07/12/70 7101 ROME FINAL REPORT: Sec. III - HARDWARE SYSTEM
Source: :RFHDW Time: 1808:56 71

4870 ARC 07/09/70 7101 ROME FINAL REPORT: Sec. III - SOFTWARE SYSTEM
Source: :RPSFT Time: 1926:19 72

4871 UNASSIGNED
73

4872 ARC 07/12/70 7101 ROME FINAL REPORT: Appendix B - THE DSS AND THE JOURNAL
Source: :ADSS Time: 1819:33 74

4873 ARC 07/12/70 7101 ROME FINAL REPORT: Appendix C - REFERENCE MANUAL FOR PERIPHERAL EQUIPMENT
Source: :HDWAP Time: 1831:42 75

4874 ARC 07/12/70 7101 ROME FINAL REPORT: Appendix D: - TECHNICAL DESCRIPTION OF NLS - Sec. I: Introduction
Source: :P2ROME Time: 1941:07 76

4875 JCN 09/22/70 ARC TASK SCHEDULES
Source: :SCHED Time: 0656:31 77

4876 UNASSIGNED
78

4877 WLB 09/24/70 NIC INTERNAL MEMO ON TELEPHONE SERVICE
09/24/70 1310:51 WLB
Source: :NIC PHONE MEMO Time: 1311:44 79

4878 WSD 09/25/70 Memo Concerning Archive System on 940
Source: :ARCHIVE NOTE Time: 1320:03 80

4879 MGC 10/01/70 Memo to JCN and JBN: where to find NIC files
and documents
Source: :JRNL2MGC Time: 1614:31 81

4880 MGC 10/02/70 Notes re tape procedures and folklore
Source: :TAPES Time: 1357:22 82

4881 MGC 10/02/70 Notes on procedure for handling NWG/RFC Documents
Attention: JCN and JBN
Source: :NWGPROC Time: 1114:15 83

4882 MGC 10/02/70 XDOC Procedures
Source: :XDOC Time: 1717:02 84

4883 MAIL 10/13/70 MAIL FILE
Source: :MAIL Time: 1112:45 85

4884 ARC 10/28/69 ARC PROPOSAL TO ONR FOR THE RINS PROJECT (Oct 69)
Source: :PRONR Time: 0951:57 86

4885 DCE 10/05/70 Memo to NIC file: ILLIAC-IV and Mike Sher's
Resource Survey
Source: :JRNL Time: 0955:51 87

4886 MAIL 10/05/70 MAIL FILE
Source: :MAIL Time: 1027:07 88

4887 DCE 10/07/70 Portrayal Generator Approach and NLS Picture
Manipulation
Source: :JRNLB Time: 0847:49 89

4888 WSD 10/06/70 A Brief Description Of the 'Core NLS' Concept,
and a guide to using super processors on the
940

5201 MAIL 11/04/70 MAIL FILE
Source: :MAIL Time: 1015:52 103

5202 DCE 10/29/70 Old but Relevant NIC Notes from Aug 70
Source: :JRNLA Time: 0911:26 104

5203 WLB 10/29/70 ENTRY TO NIC LIAISON LOG - WLB-UCSB
Source: :LIAISON LOG Time: 1047:06 105

5204 WLB 10/30/70 ENTRY TO NIC LIAISON LOG - WLB←RAND
Source: :LIAISON LOG Time: 1111:11 106

5205 WLB 10/30/70 PLANS FOR COOPERATING WITH SHER'S SURVEY
Source: :DIALOGUE SUPPORT Time: 1221:34 107

5206 WSD 10/30/70 PROPOSED EXECUTABLE TEXT FEATURES
Source: :JRNL1 Time: 1454:06 108

5207 WLB 10/30/70 MEMO RE PALO ALTO ANSWERING SERVICE
Source: :MEMO Time: 1531:07 109

5208 DCE 11/04/70 Discussion Notes, DCE/JTM: Net access for NIC users
Source: :JRNLA Time: 1303:33 110

5209 DCE 11/02/70 Some NP Notes on Analyzer Formatter and Executable Text
Source: :ETAF1 Time: 0918:42 111

5210 WLB 11/02/70 COMMENTS ON 5206 (PROPOSED EXECUTABLE TEXT FEATURES)
Source: :MEMO Time: 0919:00 112

5211 MAIL 11/06/70 MAIL FILE
Source: :MAIL Time: 1137:46 113

5212 WLB 11/03/70 ENTRY TO NIC LIAISON LOG - WLB←RAND
Source: :LIAISON LOG Time: 1108:07 114

5213 WLB 11/03/70 ENTRY TO NIC LIAISON LOG - WLB←UTAH
Source: :LIAISON LOG Time: 1054:46 115

5214 DCE 11/05/70 Notes: DCE Talk with Rubin re. SRI Info-Sys Activity
Source: :JRNLC Time: 0900:42 116

5228 JBN 11/20/70 Answering Service for the NIC
Source: :PAANS Time: 1051:01 130

5229 ARC 11/21/69 SRI Proposal for Research ESU 69-100
(Sec. I INTRODUCTION)
Source: :APRPL Time: 1608:54 131

5230 WKE 11/30/70 Teletype changes relative to the PDP-10 transfer
Source: :TELETYPES Time: 1537:56 132

5231 DVN 11/25/70 ARC RADC REPORT INTEGRATED OUTLINE
25 Nov 70 DVN
Source: :RPLAN Time: 1056:59 133

5232 WLB 12/02/70 HIGHER LEVEL PROCESSES
Source: :HIGHER LEVEL PROCS Time: 1351:32 134

5233 VDB 11/30/70 INTERACTIVE QUERY SYSTEM USERS GUIDE
Source: :JOURNAL Time: 1131:53 135

5234 ARC 07/22/70 Augmentation Research Center, Stanford Research
Institute -- Summary of major developments
from 1 August 1969 to 1 August 1970
Source: :2PRPT Time: 1145:17 136

5235 WKE 07/28/70 I/O Bus Control Multiplexor Specifications
Source: :IOMUX Time: 1649:16 137

5236 DVN 12/04/70 ARC RADC REPORT INTEGRATED OUTLINE
Source: :JRNL1 Time: 1412:30 138

5237 DCE 12/07/70 Log: Call from Steve Crocker
Source: :JRNLA Time: 1700:22 139

5238 WLB 12/08/70 NEW OUTPUT PROCESSOR USERS' GUIDE
Source: :JRNLNOPUG Time: 1400:20 140

5239 WSD 12/08/70 Proposal for Baseline for IMLAC development
Source: :BASEIM Time: 1209:36 141

5240 WSD 12/08/70 Conceptual Specification of PDP10 Mail System
Source: :10MAIL Time: 1020:13 142

5610 DCE 12/04/70 Record of visit at ARC/NIC by John LeGates,
Thurs, 3 Dec 70
Source: :JRNLP5610 Time: 1058:04 166

5611 DCE 12/04/70 Letter: DC Engelbart to John LeGates,
EDUCOM/EIN 4 DEC 70
Source: :JRNLP5611 Time: 1055:10 167

5613 JCN 12/04/70 SHER NETWORK RESOURCE SURVEY RESPONSES
TRANSMITTED TO SITES 4 DECEMBER 1970
Source: :SAVE Time: 1429:46 168

5614 DCE 12/07/70 Letter: D.C. Engelbart to George Dobbs, GM
Research Laboratory
Source: :JRNLP5614 Time: 1010:10 169

5615 DCE 12/09/70 Memo to Steve Crocker: NWG/RFC Distribution,
and Special Net Roles
Source: :JRNLP5615 Time: 1308:41 170

5617 JBN 12/15/70 DIRECTORY OF NETWORK PARTICIPANTS
December 15, 1970
Source: :DIREC Time: 1253:50 171

5618 JBN 12/15/70 TRANSMITTAL TO NIC STATION AGENTS -
Jeanne B. North, 15 DEC 70
Source: :T1SA Time: 1143:32 172

5625 DCE 12/29/70 DCE Notes: BASELINE RECORD AND ARC PLANNING
Source: :JRNLP5625 Time: 1840:50 173

5626 DCE 12/29/70 Miscellaneous Baseline Items: Scratch Notes
cf(5625,)
Source: :JRNLP5626 Time: 1626:11 174

5630 DCE 12/29/70 NETWORK MEMO, 29DEC70 DCE
Source: :JRNLP5630 Time: 1920:03 175

':5276', 01/21/71 0948:49 MEJ ; .DPR=1; :JOUSL, 01/07/71 1152:10 JCN ;

23JAN71 DCE 5280

Need in TENEX for Paper-Tape Input to NLS File

As soon as we have "transferred" to the 10, we will have need for a simple processor that replaces G-TOD -- i.e. reads a paper tape, and recognizes and executes the following flag codes as it creates an NLS file: 1

'< DELETE CHARACTER (back THROUGH one VISIBLE CHARACTER, or one INVISIBLE STRING); 1a

'> DELETE WORD (i.e. back THROUGH first preceding INVISIBLE STRING, or GAP); 1b

'$ (if last PCHAR of a statement) ABORT STATEMENT; 1c

'\ CAPITALIZE NEXT CHARACTER (only acts on succeeding character, no matter what kind): 1d

'+ CAPITALIZE UP TO NEXT INVISIBLE CHARACTER; and 1e

'' TREAT NEXT CHARACTER LITERALLY. 1f

(Note: A cluster like ">><<<" (or "<<<>>" or ">>>><<>><<<") is to be interpreted as: first delete 2 words, then delete 3 characters.) 1g

I would like soon for this little job to be fitted into the BASELINE plan for being done as soon as its priority warrants. Jim Norton and I will want to be in on te priorty juggling, and also should both have dialogue with the task pusher before he launches. 2

Priority: Obviously not before core features ready, so software guys can release the 940. But as thereafter add user features, expct Output Processor to be an early one, and this to be soon after -- even before many auxiliary parts of NLS (vector package, calculator, content analyzer, etc.), or HLPs, or etc. 2a

```
':5280', 0|/26/7| 08|5:09 MEJ ; .DPR=|; :JRNLA, 0|/23/7| |005:|| DCE ;
.HED="                                                    23JAN7| DCE 5280

Need in TENEX for Paper-Tape Input to NLS File "; Distribution: WHP CHI
WKE JCN
.SNF=72; .MCH=65; .SNB=0; .DLS=1; .SCR=2; .RTJ=0; .PGN=0; .COD[21B]=114B;
.DIR=0;       .DPR=0;
```