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GUIDE TO COMPUTING AND COMMUNICATIONS AT BROOKHAVEN NATIONAL LABORATORY

HAROLD BERRY, KURT FUCHEL, ARTHUR HARRIS, Editors

April 1991

COMPUTING AND COMMUNICATIONS DIVISION

BROOKHAVEN NATIONAL LABORATORY
ASSOCIATED UNIVERSITIES, INC.
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PREFACE

Brookhaven National Laboratory (BNL) was established in 1946 to satisfy the needs of scientists for large, complex, and expensive research equipment. BNL is operated under a contract with the U.S. Department of Energy (DOE) by Associated Universities, Inc. (AUI), which is a nonprofit corporation sponsored by nine universities (Columbia, Cornell, Harvard, Johns Hopkins, M.I.T., Pennsylvania, Princeton, Rochester and Yale), established to develop and operate large-scale research and development facilities required to serve the national need. The governing body of the corporation is a Board of Trustees which includes one scientist and one administrative officer from each of the nine sponsoring universities. The Board also includes the President of AUI and six trustees at large, who may be from other institutions.

The scientific program at BNL is intended primarily to employ the facilities of the Laboratory and the skills of its staff in the pursuit of fundamental research. Whenever feasible, BNL makes its unique resources and expertise available to state and federal agencies, especially where such work complements work done in DOE programs. Such research has frequently been the source of important new technological applications.

Visiting scientists, graduate students and scientists from other institutions collaborate with Brookhaven personnel on research projects. Other researchers, not directly connected with the Laboratory programs, use the major facilities through special arrangements.

BNL is in the approximate geographic center of Long Island, sixty-five miles east of New York City. It is located off William Floyd Parkway, two miles north of Exit 68 of the Long Island Expressway (Rt. 495). Appendix A gives information on routes to BNL and the on-site location of the Central Scientific Computing Facility (CSCF), and other facilities.

The need for computing facilities is a unifying theme underlying modern science. The trend towards decentralization has resulted in an enormous increase in the number of small and medium sized computers throughout the Lab. The CSCF is available to those users who either do not have machines available to them within their department or whose needs require the power of a large computer or facilities offered uniquely by the CSCF. The CSCF supports gateways that provide access to important national and international networks. Furthermore, the personnel of the CSCF can supply expertise in both hardware and software.

This Guide is now in its fourth revision, each revision appearing about two years after its predecessor. It is a sign of the vitality of the computing field that almost anything written two years ago is out of date. This Guide combines the *Guide to Computing* and the *Guide to Telecommunications*, a natural merger, given that communications has become such an integral part of the computing environment.

A number of changes have occurred over the past two years. The IBM 3090 has been upgraded to a multiprocessor model supporting both XA, the operating system successor to HPO, and AIX, IBM's version of UNIX. The UNIX environment continues to expand, especially in the world of the workstation. These powerful, versatile processors bring to the desktop a computing power able to handle problems formerly run only on mainframes. The balance of computing at Brookhaven is rapidly shifting away from the central facilities to a much more distributed environment with increased reliance on the connectivity provided by local and global networks.

In spite of the ever increasing volume of on-line documentation, there is still a need for hard copy information presented the traditional way, and we hope that this document satisfies it.

Arthur Harris, Kurt Fuchel, Harold Berry -- April 1991.

Revised: 04/04/91

INTRODUCTION TO COMPUTING AND COMMUNICATIONS AT BROOKHAVEN NATIONAL LABORATORY

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CHAPTER 1

INTRODUCTION

1.1 Computing at BNL

Computing at BNL has become highly distributed with each department having some computing power of its own ranging from PCs to mini-computers. The Central Scientific Computing Center (CSCF) houses the major "number crunching" machine and other specialized facilities (such as CAD/CAM), as well as the common computer communications equipment, namely the Gandalf PACX and a number of network gateway machines. The networks link BNL machines to each other and to other sites throughout the U.S. and abroad.

A list of key people associated with computing services, their functions and telephone numbers can be found in Appendix B. The most current list is published monthly in the BNL newsletter, *LINK.bnl.*

1.2 Documentation Philosophy

Much of the documentation is now in on-line facilities accessible to users with a terminal. Thus, this Guide contains information designed to give the reader an overview of each topic, and references to other documentation of a more varied nature, either in manuals, notes or on-line files.

The major information facilities are:

1.2.1 IBM VM/XA HELP and AID

An extensive on-line HELP facility forms part of the VM System on the IBM VM/XA. HELP files are available for system commands and for various tasks. Typing HELP TASKS gives a list of HELP topics.

The AID Utility is an on-line topical index. Its function is to assist users in obtaining sources of information such as on-line HELP and various off-line information pertaining to a topic. It allows users to view HELP files directly while still in AID. On the IBM VM/XA the AID command takes one or two keywords as arguments; e.g. typing AID BATCH results in a list of suggestions for help pertaining to the BATCH facility.

1.2.2 VAX HELP and AID

Most information concerning the VAX CLUSTER can be found in on-line help files. After connecting to the Cluster, type HELP to find descriptions of the features of the system and software. After the topics supplied by DEC, the user is directed to additional HELP files where information pertinent to this computing center can be found. These files include data on such things as schedules, communications, third party software and so on. For help relating to BNL topics, type AMD.

Information of immediate interest is output at login. The command NOTICE can be used to redisplay this information.

The AID Utility is available on the VAX Cluster as well as on the IBM VM/XA (see Section 1.2.1 above). It allows users to display a list of help sources related to a specified keyword. For example, typing AID FILE_TRANSFER results in a list of suggestions for help pertaining to moving files from one system to another.

1.2.3 LOGIN News Facilities

Items of immediate interest to users are output at LOGIN or as part of the header for batch jobs. Older and less immediate messages are maintained in various files. To examine these, proceed as follows:

IBM VM/XA:

Type NOTICE to display the most current LOGIN message.

Type BNLPOST to display a list of seminars, meetings, etc.

Type NEWS LIST to display a list of news items; the list contains a number for each item. To examine the items, type: *NEWS n* where n is the number of the item.

VAX/VMS:

Type NOTICE to display the most current LOGIN message.

Type BNLPOST to display a list of seminars, meetings, etc.

1.2.4 Newsletter

LINK.bnl is published jointly by Management Information Systems (MIS), Technical Information Division (TID) and CCD approximately on a monthly basis. It is the

newsletter for all computer users at the Laboratory. Contact the HELP Desk at x-4159 to register for the newsletter.

1.2.5 Documentation Library

The Manual Library, located in the CSCF, stocks manuals from computer or software manufacturers. It keeps available hard-copy documentation on a variety of topics. BNL documents on selected topics are also available from the library.

The Manual Library also stores subscription magazines and other publications which may be consulted or borrowed. These are mainly technical and trade publications and catalogues, largely in the PC area.

A list of primary reference manuals appears in Appendix C.

CHAPTER 2

COMPUTING HARDWARE AND OPERATING SYSTEMS

Many parts make up the whole of the CSCF hardware environment. Several computers, each in itself capable of supporting a "large scale" computing center, work together serving both local and long distance users. Attendant mini- and micro-computers, communications gear, I/O and other peripherals complete the hardware picture.

Figure 2.1 depicts an overview of BNL computers and the networks linking them.

2.1 IBM 3090-300E (ID: BNLVMXA or AX1)

The 3090 Model-300E is a three processor machine with Vector Facility. The system is configured with 64 megabytes (Mb) of memory and 42.5 gigabytes (Gb) of disk storage. Use the ID *BNLVMXA* to logon to the basic operating system, VM/XA (Virtual Machine / eXtended Architecture). XA offers a large virtual memory (up to 999 Megabytes for batch jobs). The IBM is intended for large calculations supporting both batch and interactive use, with the emphasis on batch. Use the ID *AX1* to logon to AIX, IBM's version of UNIX, which runs as a guest system under XA.

Direct terminal access is available, supporting both ASCII and IBM terminals. A network link between the VAX Cluster and the IBM VM/XA provides for file transfer in both directions as well as login to the 3090 from the Cluster or from a UNIX machine via TELNET. Job submission from the Cluster to the IBM VM/XA and output spooling from the 3090 are available, as are Bitnet and TCP/IP.

The system also has access to STC tape drives (1600/6250 bpi), two 4245 printers, and a 3480 cartridge tape subsystem. 8 mm cartridge drives are also available.

2.2 VAX/VMS Cluster (ID: BNLCL6, etc.)

The BNL VAX Cluster consists of a 5-CPU Digital Equipment Corporation (DEC) 6450 (BNLCL6) and three VAX 11/785 computers (BNLCL1,3,4). The current operating system is VMS version 5.4 (the command SHOW CLUSTER will give the current VMS version and the current Cluster nodes).

The Cluster machines share 15 RA81 disks with a capacity of 456 Mb each, 9 SI93 disks of 842Mb each and one SCSI disk giving a total capacity of 15Gb of on-line storage. Additional equipment includes five TA/TU78 tape drives capable of operating at 1600 or 6250 bpi, two TU77 tape drives operating at 800 or 1600 bpi, two LP27 line printers, and several QMS and Talaris laser printers/plotters. An Ethernet links the machines to each other and to

several Terminal Servers, as well as to the IBM VM/XA and to DECNET routers. The routers link the Cluster to other VAXs both on and off-site.

2.3 UNIX Systems (IDs: ax61, ux1, ax1, max, etc.)

The UNIX operating system runs on an IBM RS/6000 RISC workstation (ID *ax61)* as well as on the IBM 3090 (ID *ax1*); both run AIX (IBM's version of UNIX based on AT&T's system V, enhanced with Berkeley's BSD commands). A DECsystem 5000 runs DEC's ULTRIX operating system; an Encore Multimax runs UMAX 4.3. There are also various SUN systems which play a role as file servers. TCP/IP, Bitnet and UUCP protocols and an electronic mail system are supported, as well as the standard UNIX facilities. ULTRIX is similar to Berkeley's BSD 4.2, as are the systems that run on the Encore and the SUN.

2.4 Access to CRAY at MFE

A number of BNL groups have allocations of time on the Energy Research CRAY at Lawrence Livermore National Laboratory's National Energy Research Supercomputer Center (NERSC). These groups have been allocated NERSC time because the nature of their computational needs dictates use of the Center's CRAY facilities. Contact Len Slatest at x-4102 for additional information.

The NERSC computers can be reached via Mfenet from the VAX Cluster and from any BNL system supporting TCP/IP.

2.5 Workstations and CAD/CAM Facilities

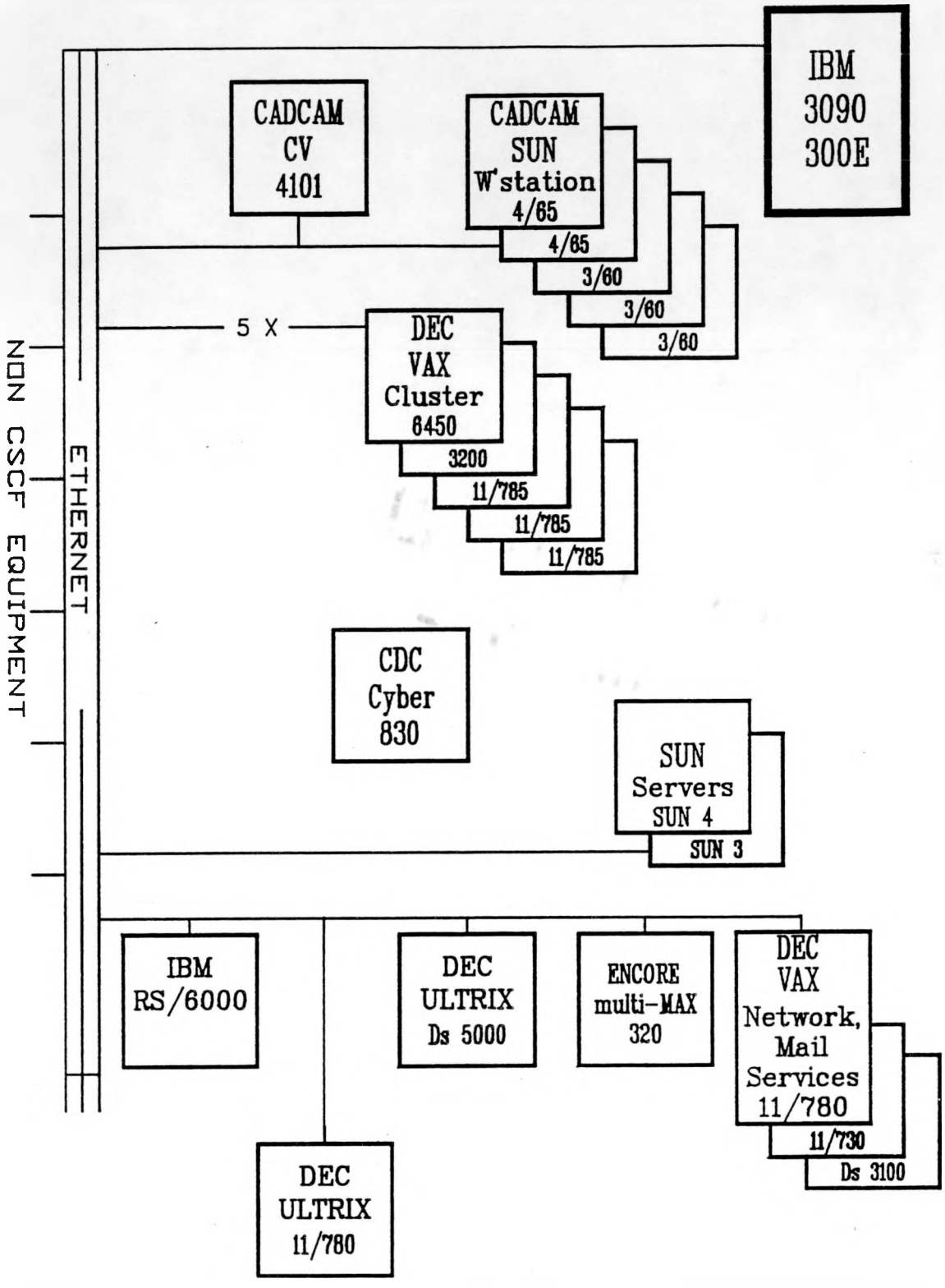
The number of workstations, most of them SUNs, continues to grow. Many of these are used in Computer Aided Design and Manufacturing. The CAD/CAM facilities are described in detail in Section 8.2.

Most of these workstations are networked together via Ethernet links. See Chapter 7 for details.

2.6 Personal Computers

The number of Personal Computers on site is now in excess of 2000. Machines supported by the CCD are described in section 3.6.

CENTRAL SCIENTIFIC COMPUTING FACILITY



1/28/91

Figure 2-1

BNL CADCAM DRAWING

CHAPTER 3

SUPPORT SERVICES AND FACILITIES

It is the responsibility of the CSCF staff to keep the center running smoothly for the user community. Some groups provide direct services while others support the service groups. The CSCF provides certain facilities for users such as the Ready Room, the Manual Library and the PC Store. This section describes the service groups and user support facilities.

3.1 HELP Desk and Consulting

The HELP Desk is staffed by one or more technical specialists during the day shift. Their function is to supply aid and instruction in the proper use of procedures and control statements and interpret diagnostics, debugging, etc. However, they will not perform programming for users.

The HELP Desk, which is located in the CSCF (Building 515), can be reached by telephone or by sending an electronic message to the IBM, VAX or UNIX machines. Questions or suggestions sent to these locations will ordinarily receive either an answer or an acknowledgment within one working day. The answer will be sent to the user via electronic mail, or otherwise as specified. Access to these facilities is as follows:

- HELP Desk phone number x-4159
- IBM: Enter CONSPIRE BROWSE SOS to read existing questions and answers. Enter CONSPIRE ADD SOS to add a message or question to the conference.
- VAX: Use the VMS MAIL utility to send your question to *HELPDESK*.
- UNIX: Use the UNIX mail utility to send your question to *helpdesk*.

The IBM On-line Conferences

The CONSPIRE command mentioned above is one example of a simple conferencing utility on the IBM VM/XA. There are several CONSPIRE conferences, each representing a particular area of interest (e.g. DISSPLA) plus the SOS conference which serves as a general question/problem dialogue. Most of the conferences are open to all users, so your questions and suggestions may get "official" or "unofficial" responses. All are monitored by CSCF staff or conference "owners" who will endeavor to answer your questions (or to correct answers given by others). To learn how to use the conferencing system, type: HELP CONSPIRE.

Consultant Specialists

If a problem cannot be resolved quickly by the HELP Desk personnel, it will be referred to a specialist in the appropriate area.

3.2 Programming and Engineering Services

Users may obtain the following services subject to availability of CCD support personnel:

a) Designing, programming, testing and documentation of programs, subroutines and user-defined application packages;

b) Design and implementation of data bases using an available database management system;

c) Conversion of existing programs written for computers or operating systems other than those in use at the Brookhaven CSCF, and modification of these programs for increased capability and efficiency;

d) Investigation of the causes of run failures for existing programs;

e) Consultation on general aspects of programming or use of computing equipment, numerical analysis, CSCF library subroutines, networks, communications and special problems in existing programs;

f) Digital system design services and consultation on digital hardware.

The HELP Desk, x-4159, will direct users to the appropriate person.

3.3 Ready Room Work Areas

Adjacent to the computer room are several work areas containing terminals, PCs and workstations for general BNL use. There are also several laser printers available (both black and white and color). Consult the Help Desk (which is adjacent to the work areas) for assistance.

3.4 Manual Library

The CSCF Manual Library stocks manuals from manufacturers of computers and software for resale to users. An ILR (Intra-Laboratory Requisition) with valid signature and account number is required; it is recommended that an open ILR be used. Certain books on computer science topics are also available, some for resale, some for loan. In addition, the Manual Library is the redistribution point for local hardcopy documentation and microfiche.

Recommended manuals for both the VAX and the IBM can be found by entering the command AID MANUALS.

A set of UNIX and PC related books, magazines and sales brochures are available for consultation, loan and sale.

3.5 Personal Computer and Workstation Software Library (PC Store)

Programs and packages for PCs and workstations are available for sale against an ILR. The PC Store is described in more detail in Chapter 8.

3.6 Hardware Services

The CCD Hardware Services Group, which is part of the Engineering and Telecommunications Section, maintains selected DEC equipment, various personal computer systems, the Lab-wide network, work-stations, and peripheral equipment produced by many different vendors.

Traditional computer hardware repair functions can be obtained from the CCD Hardware Services Group by submitting an Intra-Laboratory Requisition (ILR) with the necessary signature authorizations. An open ILR can be issued for an entire fiscal year or one can be issued for each transaction. The policy is that group members will not respond to service requests until the ILR has completed all approval stages. We urge users to process yearly open ILRs to minimize delays for service calls. Charges made to the ILR will be for: replacement parts used; labor when preventative maintenance functions occur; labor for computer installations and deinstallations, and labor performed outside normal working hours. Labor is not charged for hardware repairs to computers that experience a component failure when the labor is expended during normal working hours.

Full service is provided for supported equipment (for which there exists an on-site inventory of replacement parts and repair expertise). Best-effort service is provided for unsupported equipment. The normal working hours for the repair service are 7:00 a.m. to 11:00 p.m., Monday through Friday, except holidays. Group members troubleshoot computer problems to the field replaceable unit (FRU). Then a decision is made if it is cost effective to repair or to replace the unit. For service, call x-4145. To discuss policies or issues call the Hardware Services Supervisor, Ed Brosnan x-4114.

The following list of equipment is a condensed version of equipment that has Lab-wide use and that the Hardware Services Group supports.

SUPPORTED EQUIPMENT

SYSTEMS:
VAX 11/730 with FP 730
11/750 with FP 750
11/780 with FP 780
11/785
MICROVAX II
MICROVAX 3100
MICROVAX 3200
MICROVAX 3500
MICROVAX 3600
VAX STATION 3100 model 30
VAX STATION 3100 model 40
VAX STATION 3200
VAX STATION 3500
VAX STATION 3600
PDP 11/23
PDP 11/34
PDP 11/73 KDJ11-Ac
LSI 11/03
LSI 11/23
IBM: PC, AT, XT
PS2 models 50,50z,55sx, 60,80

ABEST: 286 AT clone, 386 SX clone, 386 DX clone

IBS: 286 clone

SUN: 3/50 with 19 in monochrome display

SPARC station 1+ with color display and Quantrum hard disk

APPLE: Macintosh II, IIA, SE, SE/30, classic, LC, IIx, IIfx, IIci, IIsi

DISPLAY UNITS:
IBM 8503, 8513, 5154, 5151
NEC Multisync II, IIA

LAN BRIDGE:
RETIXGATE: 2244 802.3 LAN 100

DISK UNITS:
CDC 9766
DEC RA80, 81, 60, RD52, 53
RM03, RMO5, RM80, RL01,
RL02, R80, RX50, RZ23
SCSI
Hitachi 670MB

TAPE UNITS:
DEC TE16, TU77, TU78, TU58,
TK50, TK70
STC 3650, 3670, 1953
KENNEDY 9000
SCSI Exabyte 8200 8mm tape

PLOTTERS:
VERSATEC V80
HEWLETT PACKARD 7470, 7475A

TERMINALS:
DEC VT100, 102, 220, 240, 320, 340

PRINTERS:
DEC LA120, LA180, LA34, LA36,
LXY22, LP27
OKIDATA u82, u92, u93
EPSON FX86, 286, 850,
APPLE 1050
HEWLETT PACKARD LaserJet II
LaserJet III
Apple Laser Writer II NTX
Apple Image Writer II

COMMUNICATIONS INTERFACES:
DEC DEQUNA, DEUNA, DMF32, DZ11,
DMR11, DMZ32, DD11-KT,
DLV11-J, DELNI-AA

TERMINAL SERVERS:
EMULEX, DEC, XYPLEX

DATA SETS:
Gandalf LDS 125

3.7 Software Acquisition Coordination

The acquisition of software, both vendor and third party, is becoming a very complex and expensive business. The Computing and Communications Division attempts to mitigate this situation by offering assistance to other departments based on its own experience in this matter. Moreover, others are asked to provide input to CCD of their own experiences and needs in the software area. Sometimes a coordinated purchase can result in discounts, cost sharing and less duplication of red tape. Users planning to purchase software (other than for PCs) are urged to call Carole Saurino at x-4151.

Members of the CCD are available to offer advice and assistance in evaluating major software being considered for purchase. Very often this assistance takes the form of coordinating the knowledge of people outside CCD known to be expert in a particular software area.

CHAPTER 4

GETTING STARTED USING THE CSCF

4.1 Non-BNL Users (BNL users start at Section 4.2)

A. Inquiries regarding the use of the CSCF should be directed to:

Mr. Harold Berry — 516-282-4152
Brookhaven National Laboratory — FTS-666-4152
Computing & Communications Division
Email: berry@bnl.gov
Building 515
Upton, NY 11973

B. A purchase order covering the cost of the intended usage should be sent to:

Mr. Bernard J. McAlary — 516-282-3330
Business Manager — FTS 666-3330
Brookhaven National Laboratory
Building 460
Upton, NY 11973

The purchase order must include the following:

1. Identification of the source of funds supporting the work.

2. The term of the purchase order.

3. The expenditure authorized.

4. A list of authorized signatures, including first name.

5. The names of all individuals who may appear at BNL authorized to utilize the computers under the purchase order.

6. If this work is related to use of any BNL experimental facility or to collaborative BNL research, describe this relationship; otherwise describe the nature of the work and the justification for doing it at BNL.

C. When the purchase order has been accepted, the Business Manager will establish a Brookhaven financial account.

D. Brookhaven may request an advance payment of funds in certain instances.

E. The requestor will be notified regarding acceptance of the purchase order.

The authority to commit funds from a financial account is delegated to specific individuals by giving them signature authorization for the account. The signature of one of these individuals is required on all documents which authorize charges to be made to the account. In particular, an authorized signature is required on certain internal requisition forms before use of the CSCF can be obtained. The signature for a non-Brookhaven user's account should be assigned to some appropriate representative of the user. Therefore, the purchase order submitted by the user's organization should name those individuals who are to have signature authorization for the user's account.

Services rendered under a valid requisition are charged to the account specified on the requisition. The Fiscal Division of the Laboratory thereafter prepares and forwards an invoice monthly to the user's organization covering the services charged to the user's account. Charges to a user account may only be generated by designated personnel of a user organization, and adherence to any dollar ceiling remains the responsibility of the user organization. Inquiries about charges should be addressed to:

Dorothy Scheffer 516-282-2323 or
Stuart S. Rideout 516-282-4108.

Once an account has been established for an outside user, the user must then follow the same procedure as for BNL employees, specified below.

4.2 BNL Users

BNL users must fill out a Computer Services Requisition form which can be obtained from:

The HELP Desk 516-282-4159 (or x-4159)
Building 515

Users who plan to use the IBM VM/XA, the VAX/VMS, or any of the CSCF UNIX machines must register with the HELP Desk.

This form must carry a valid Laboratory account number, and an authorized signature for the account in question. A problem number, which is required to access the CSCF computers, will then be issued to the user.

4.3 Access and Login Procedures

Interactive access to the CSCF computers, and most other computers at BNL, is provided through a Gandalf PACX 1000 Data Switch which permits asynchronous communications

to a selected computer or terminal server at speeds up to 9600 baud. Off-site users cannot gain access to BNL computers until they have registered for a Security Access ID number; to register, call the HELP Desk at x-4159.

On-site users gain access to computers through direct network attachment or through dialup lines or via a Gandalf LDS 125 using the following steps: Set the thumb dial to 40, raise the switch and hit carriage return several times until the message *Enter Class* appears. Then enter either the numeric or mnemonic code of the service desired. Again, it may be necessary to press carriage return several times for the receiver to detect the correct baud rate (autobaud). The access codes are listed in Appendix D, which also describes how to use the Gandalf to dial telephone numbers via the DIAL facility. Responding to the Enter Class prompt with ST will list most of the available classes. The Gandalf switch can be reached by either on-site or off-site telephones; users then follow the procedure described above.

Terminals and printers running in 8-bit no parity mode can communicate with the IBM, the VAX Cluster or the UNIX machines.

4.3.1 IBM 3090 VM/XA (BNLVMXA)

The VM/XA operating system allows interactive access, submission of batch work, and is also linked to the VAX Cluster and the UNIX machines. VAX users can transfer files between the Cluster and the 3090 and also log on to the IBM machine from the VAX. Remote job entry and output file retrieval is also available.

A device called the 7171 enables users of ASCII terminals to communicate with the 3090 as if they were IBM terminals. This device is accessed through the Gandalf PACX in Full Duplex mode (8-bit NO PARITY): the class code is **IBMXA**. The user receives the following prompt from the 7171:

ENTER DEVICE TYPE:

and responds appropriately for his particular terminal.

For example:

VT100

If the 7171 recognizes the device type, the user is connected to VM/XA which will then display a full-screen VM "logo" starting with the line:

VM/3090 ONLINE -- PRESS ENTER OR CLEAR KEY TO BEGIN SESSION

The BNL logo will appear in large letters in the middle of the screen, and the message RUNNING BNLVMXA will appear in the lower right-hand corner. After the word LOGON, which appears in the lower left hand corner, enter your userid. You will then be prompted for your password.

After you LOGON for the first time, you should change your password using the *SET PASSWORD* command.

For more details, refer to the VM-CMS Tutorial, April 1990 Edition, which is available from the Manual Library.

4.3.2 VAX/VMS (BNLCL6, etc.)

The VAX Cluster may be reached via the Gandalf PACX. Your terminal should be set to Full Duplex mode (8-bit NO PARITY). Class code 111 on the Gandalf is used to access any of the Cluster nodes. After entering class code 111, the response will be

Class start

Enter several carriage returns to allow the terminal server to autobaud. You will be prompted for your username. The response will be:

Local>

The user requests to be connected to a particular service, for example:

Local> *Connect BNLCL6* (or simply *C BNLCL6*)

or

Local> *Show Services BNLCLUSTER*

to display a list of available Cluster nodes.

Once the connection to the particular service has been established, the user is asked to login, and should respond to prompts with userid and password.

Jobs on VAX/VMS can be run either interactively or submitted in a batch mode via the *SUBMIT* command. Consult DEC manuals and HELP files for details.

It is recommended that users change their password frequently via the *SET PASSWORD* command.

The default number of disk blocks assigned to a VAX user is 1,000. This can be modified by calling The Help Desk at x-4159 or Operations at x-4113.

4.3.3 UNIX (BNLUX1, etc.)

Access to VAX/UNIX is quite similar to VAX/VMS; it also operates in Full Duplex mode; from Gandalf class code 111 (see previous section), in response to the **local>** prompt, enter *c bnlux1*. Once the connection is made, the system issues the prompt:

login:

to which the user responds with his name; the system then prompts the user for a password.

Access to other UNIX hosts, for example the RS/6000 or the ENCORE MULTIMAX, is done in a similar manner. Enter *c ax61* for the RS/6000 or *c max* for the MULTIMAX.

4.3.4 ANNEX and ANNEX2

The annex is a terminal server that attaches terminals to an Ethernet. Through the annex users can access any host computer on the local Ethernet that supports TCP/IP. In addition, the user has access to all other host computers on the Internet. This allows the user to enter either the *telnet* or *rlogin* command in order to logon to any system on which he has permission to do so.

The annex can be reached by first entering *annex* in response to the GANDALF prompt **Enter class**. At the **annex** prompt, enter a *telnet* or *rlogin* command to connect to the desired host computer. (Note: it might require one or two carriage returns to get the **annex** prompt). To get a list of the annex commands, issue *?* at the **annex** prompt.

An alternative way of connecting to the annex server is to use the *telnet* command from any host computer on Internet.

The annex2 is an alternate terminal server whose function is to connect directly to the IBM VM/XA. This makes the IBM available to any user on the Internet. A user can connect to annex2 by issuing a *telnet annex2* command in response to the **annex** prompt.

4.4 Charges and Usage Accounting

The costs of the CSCF are directly allocated to the Laboratory programs and there are no usage charges imposed on most users of the CSCF. Relative usage is reported and controlled by a priority scheme which assigns reduced priorities to those users who have used a significantly larger fraction of resources than the fraction of the costs which their program has provided. The only effect this reduced priority has is to resolve contention for scarce resources. Outside users continue to pay usage charges on a monthly basis.

CHAPTER 5

CSCF SOFTWARE

Much software is required to support the CSCF hardware. Systems software includes the operating systems, utilities, and language processors. In addition, a growing selection of applications software and packages including data base management systems, graphics, statistical and mathematical packages are available.

5.1 Languages & Tools

A variety of general purpose, higher level programming languages and tools are supported by the CSCF computers. Software listed as UNIX may not be available on all UNIX systems. A sampling includes:

- FORTRAN 77 on all machines
- C on VAX/VMS, UNIX. Watcom C on IBM VM/XA
- C++ (Object Oriented) on IBM RS/6000 AIX
- PASCAL on VAX/VMS and UNIX
- TOSCA on VAX/VMS
- PE2D on VAX/VMS
- LISP on Encore UNIX
- MACSYMA on Encore UNIX

5.2 Mathematical and Statistical Libraries

- ESSL(Engineering Scientific Subroutine Library) on IBM VM/XA Vectorized and non-vectorized versions are provided.
- IMSL (International Math. and Statistics Library) on IBM VM/XA and VAX/VMS
- NAG (Numerical Algorithms Group) on VAX/VMS and IBM VM/XA
- SLATEC (Sandia Los Alamos Technical Exchange Committee) on IBM VM/XA and VAX/VMS
- CERNLIB on IBM VM/XA and VAX/VMS and UNIX (unsupported software)
- MATHEMATICA on IBM RS/6000 AIX
- SAS and SAS/graph on VAX/VMS
- SPSSX and SPSS/graphics on VAX/VMS

5.3 Code management

- CMS/MMS on VAX/VMS
- HISTORIAN on VAX/VMS and IBM VM/XA

5.4 Database Systems:

- SQL/DS on IBM VM/XA
- Rdb on VAX/VMS
- SYBASE on SUN Workstations
- dBASE and R:base, etc. on PCs

5.5 Graphics and Text Formatting

- DISSPLA Graphics on VAX/VMS and IBM VM/XA
- PVWAVE Interactive Graphics on VAX/VMS, SUN/UNIX and VAX/ULTRIX
- TEX on VAX/VMS, IBM VM/XA and UNIX

5.6 Other Application Packages

The IBM VM/XA has a wide variety of software packages not bundled with the operating system. The types of software provided include: graphics, data management, mathematics, statistics, text processing and others. The packages and products available change with new developments in the industry and needs of the user community.

Use *AID keyword* (e.g. *AID graphics*) to see which specific products are available, or enter the command: *AID product* for a list of all available products.

The VAX Cluster also has a variety of software packages. Use *AID keyword* as on the IBM VM/XA. Specific software packages may only be available on certain Cluster nodes.

On UNIX machines, use the *apropos* command (or *man -k*) to get a list of relevant software; then use the *man* command to get more specific information on available software.

CHAPTER 6

DATA COMMUNICATIONS SERVICES

6.1 Interactive Computing Access

The Computing and Communications Division (CCD) provides interactive access to a VAX Cluster (VMS), a Decstation 5000 (Ultrix), an IBM RS/6000 (AIX) an IBM 3090 300E (VM/XA and AIX) and a number of smaller computers located in the Central Computing Facility and at other locations throughout the site.

6.2 Data Switch

One method of connecting users to computing resources at BNL is via dedicated connections to a GANDALF PACX 1000 Data Switch located in the Central Computing Facility (CCD). The switch permits asynchronous communications to a selected computer or other resource at speeds up to 9600 bits per second (bps). A second, smaller PACX 1000 services the MIS computer center's Hewlett Packard computers. Inter-switch trunks allow users with terminal connections to either switch to reach resources on the other. Users' terminals or PCs are connected to the data switches over 4 wire telephone cable facilities.

Establishing a connection involves responding to an **Enter Class** prompt from the PACX Switch with the Class number or alphanumeric identifier of the desired service. Refer to section 4.3 for further details. The present status of the host machines at the Central Computing Facility and a listing of most often requested classes are obtained by selecting Class *ST*. This listing also appears in Appendix E.

Occasionally, either because of insufficient cable capacity or simply as an economy measure, multiplexers are employed when multiple switch terminal connections are requested to the same area.

A user issues an ILR to CCD/NET Section to order a connection to either switch. The cost includes all communications hardware up to the user's RS-232 terminal interface. (Costs periodically change to meet expenses; consult the Laboratory listing of standard rates, or the Data Communications group on x-4199 for the latest information.) Computer resources not located in the Central Computing Facility (Bldg.515) are connected to the port side of the switch via dedicated circuits and limited distance modems. Port connections for computers may be ordered from CCD.

6.3 Dial-Up Communications

Asynchronous dial-up access to the PACX switch (from off-site) is offered at speeds of 300, 1200, 2400 and 9600 bps. Once in the switch, dial-up users have access to the same resources available to users with dedicated connections. (9600 bps for on-site dial-ups will be added in FY'91)

The following modem types are supported:

1. Bell 212A at 300 or 1200 bps.
2. CCITT V.22 at 1200 bps, and V.22-bis at 2400 bps.
3. CCITT V.32 at 9600 bps.

Note: Racal Vadic 34XX series modems are no longer supported unless they can run as a Bell 212.

Users calling from off-site must satisfy a Security Access System before being given access to the PACX data switch. A visit to the Help Desk in CCD is usually required in order to register for a Security Access ID number and to obtain instructions for its use. This number must be entered by the user from a Touch Tone device (telephone or autodial modem) after dialing the number of the Security Access System. The user is then called back by the system and a normal data call commences. Users should discuss their particular dial-in requirements with M. Torres, at 282-4199, to explore additional features of the Security Access System.

6.4 MODEM Pool

There is an autodial modem pool available as a PACX resource. All standard modem speeds from 300 - 9600 Bps are supported. These modems may be accessed by a PACX user and requested to dial a remote computer. The class is:

DIAL for call to all areas (See Table 6.1)

Account codes are required to place off-site calls from this facility. Users selecting Class DIAL will receive a message instructing them to use an Account Code. See Account Code description under Billing Procedures in Chapter 11.

Class DIAL Sequence

PACX or MODEM	USER
Enter Class:	*DIAL* <CR>
Class DIAL Start	*Ctrl E* <CR>
Hello, I'm ready	*D*<CR>
Number?	*number* <CR>
DIALING...	
ON LINE (Audible beep)	
...or...	
BUSY or FAILED CALL	*R*<CR>
Number of retries	*n*<CR> ($n \leq 9$)
...loop back to	
DIALING...	

Table 6.1

The phone number is 4 to 20 digits long with dashes omitted; for example, enter:

654321921255512 12

to call 9-212-555-1212 with Account Code 654321. If an error is made, a recovery can be attempted by entering:

I <CR>

followed by:

Ctrl E <CR>.

6.5 Other Dedicated Services

DECNET

Dedicated connections to a DEC Router Server are available at speeds of 9.6, 19.2 and 56 Kb over on-site telephone cable facilities or 9.6 Kb over leased 3002 common carrier circuits.

IBM 3270 Terminal Connection

3270 type terminals may be connected via RG62-U coaxial to a 3174 controller located in the Computing and Communications Division (CCD), Bldg. 515. Terminals less than 900 ft from the controller may be connected over twisted pair telephone cable by employing matching transformers (baluns) at each end. Remote multiplexers connected to the 3174 via coaxial cable or fiber optics may also be employed to support Clusters of 8 or less terminals.

Ethernet

The following buildings are connected to the BNL site-wide Ethernet:

97	459	490	750	940
120	460	510	901	1005
134	463	515	902	
421	477	555	911	
452	480	725	912	

All Ethernet packet types are supported. Terminals connected to LAT-compatible terminal servers may establish virtual connections to any DEC host running LAT on the Ethernet. Most terminal servers supported by the CCD enable users to establish either LAT or TCP/IP sessions. All VAX Cluster machines in the CCD also support TCP/IP access. Reverse Terminal servers, at CCD, enable users on the network to access non-LAT hosts or the modem pool via the PACX data switch.

The interconnection scheme of the site-wide extended Ethernet local area network is shown in Figure 6.2

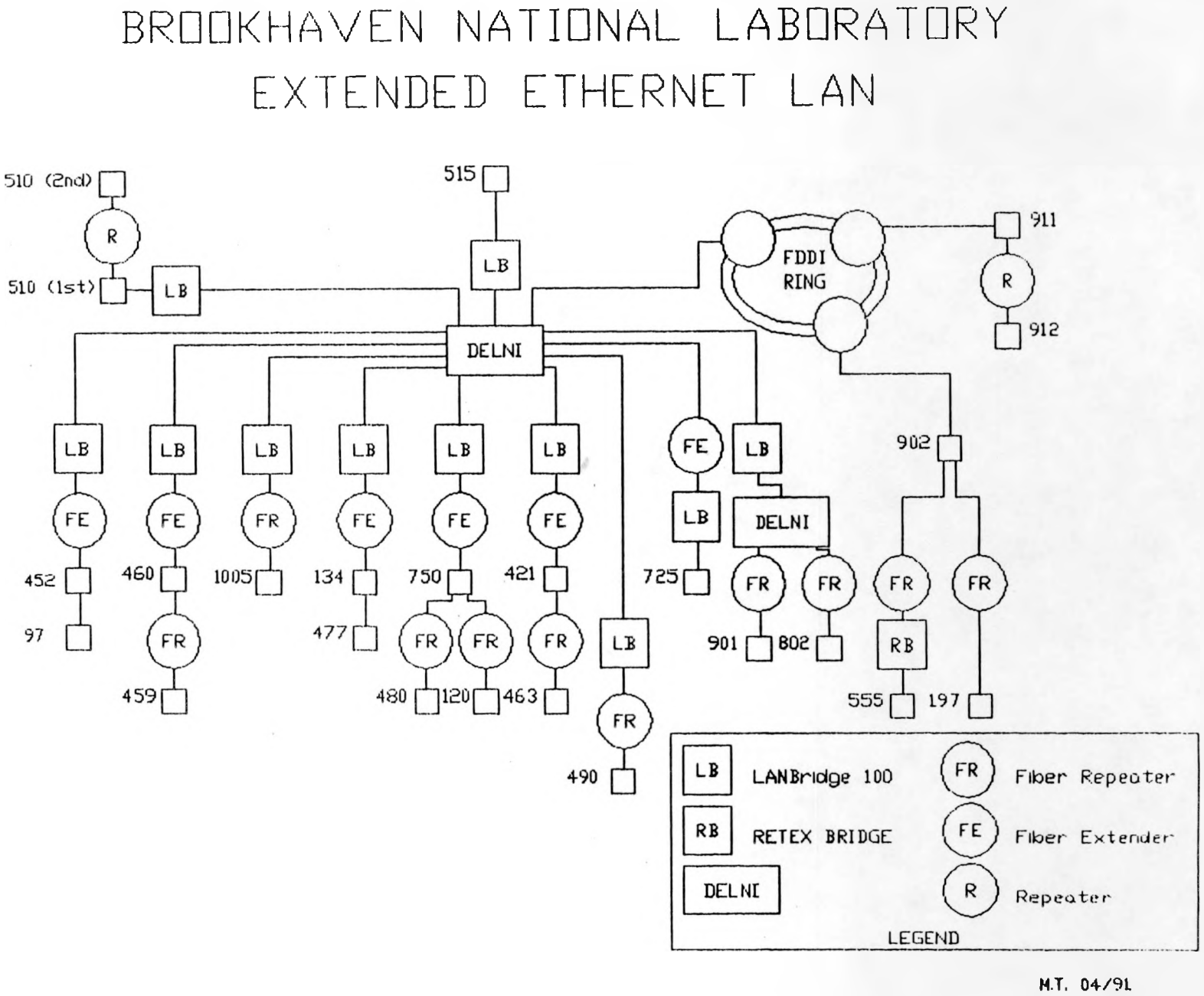


Figure 6.2
BNL Extended Ethernet LAN

CHAPTER 7

COMPUTER NETWORKING

The rapid evolution of networking technology is producing major changes in the style in which scientists pursue their research. An individual scientist now has access to an increasingly wide range of resources, such as high quality output devices, special purpose processors, remote supercomputer facilities, etc. Another facet of this technology is the possibility of rapid interchange of mail and programs, making it possible for scientists at geographically dispersed locations to join in collaborative efforts. In the following sections we will describe the networking facilities which are available at BNL.

7.1 Local Networks

In this section we describe the manner in which computers at BNL are interconnected. The computers we will be referring to include minis, super-minis, workstations and mainframes. There are three operating systems which are represented in this collection of systems - VMS, UNIX and VM/CMS. Most of the computers at the Laboratory belong to individual groups or departments and access to them is restricted. The facilities at the Central Scientific Computing Facility (CSCF) are available for general Laboratory use. They include an IBM 3090/300E with the vector facility, a VAX VMS Cluster, a DECSYSTEM 5000 running ULTRIX, an IBM RS6000/530 running AIX and an assortment of line printers and laser printers. The main protocol families used to link this assortment of systems are DECNET and TCP/IP.

Access to these systems, and to most of the host systems at the Laboratory, is via 10 megabit Ethernet links. The BNL LAN currently consists of a number of Ethernet segments linked to a high speed (100 megabit) high speed connectivity. In order to increase network reliability, the use of subnets is being introduced. The FDDI component of the network is slated to be increased over the next two years; systems with I/O requirements beyond Ethernet capacity will have direct FDDI access.

7.1.1 DECNET

DECNET consists of a suite of networking protocols developed by the Digital Equipment Corp. for its PDP-11 and VAX computers and has a long history of use at BNL. The early BNL DECNET installations consisted largely of 56 kilobit point-to-point links utilizing the DDCMP protocols. Over time this has evolved to a configuration based on 10 megabit Ethernet segments servicing major components of the Laboratory, with the segments bridged by fiber optic links.

A user logged in to a system on which DECNET is installed has access to the standard capabilities provided by modern networks, i.e., file transfer, remote login and electronic

mail. A significant strength of DECNET is its integration into the VMS operating system, which makes it possible for selected VMS commands to function across the network in the same manner as they function on the system the user is logged into.

7.1.2 TCP/IP

The other major protocol used at BNL is TCP/IP, which is the outgrowth of pioneering network research performed under the sponsorship of DARPA. Unlike DECNET, which is a proprietary product of DEC, TCP/IP implementations are available from a number of vendors and run on a wide variety of computer systems. The requirement to network together computers supplied by different vendors led to the decision to use TCP/IP at the Laboratory.

Because TCP/IP runs on dissimilar operating systems it is not as integrated into each operating system as is the case with DECNET and VMS, but the same basic functionality is supplied. Bi-directional file transfer is done by invoking the FTP utility, and remote login is done by invoking the TELNET utility. Each of the TCP/IP vendors represented at BNL supports an implementation of electronic mail corresponding to the SMTP (Simple Mail Transfer Protocol) protocol. The TCP/IP implementation installed on VMS systems is Multinet which is licensed for Lab-wide use. The version in use on the IBM VM/XA, called FAL, is supplied by IBM, and UNIX systems include TCP/IP as a standard feature.

The principal CSCF systems from the networking perspective and the connections to external networks are displayed in Figure 7.1. Although not mentioned above, access to Bitnet is available on the 3090, DAGVAX, BNLCL1 and ULTRIX VAX systems. Bitnet will be described further in the following sections. It should be noted that a number of the CSCF VAX systems as well as the BNLDAG machine support both DECNET and TCP/IP access, making it possible to use them as gateways between the two protocol families. We expect to exploit this capability to provide users with transparent access across the combined networks.

7.2 National Networks

The Laboratory is connected to a number of national and international networks. A necessarily brief description of the most important of these networks follows.

7.2.1 Bitnet

Bitnet provides access to a worldwide network of universities and research laboratories. It was originally developed as the result of collaboration between City University of New York and Yale University and used the IBM RSCS protocols to connect their IBM mainframes. With the passage of time, Bitnet was extended to run on VAX VMS systems, where the JNET software is used to emulate the RSCS protocols, and on UNIX systems, where the corresponding software is called UREP. Bitnet has links to the European Academic

Research Network (EARN) and Netnorth (a Canadian network). It supports file transfer and electronic mail but does not provide remote logon capability. Bitnet utilizes the store and forward method to transport files, which results in a limit on file size since each intermediate node must store the entire file on disk before forwarding it.

7.2.2 Internet

Today's Internet is a packet switching network based on the pioneering work done by the Defense Communications Agency for the Department of Defense (DARPA) in developing the TCP/IP protocol familiy. It consists of a collection of interconnected networks which use the TCP/IP protocols. The Internet has grown dramatically in recent years; currently there are over 200,000 systems attached to it. The Nsfnet is an important component of the Internet because it operates a high speed nation-wide backbone. This backbone is being upgraded from T1 links (1.5 megabits/sec) to T3 links (44.7 megabits/sec) to satisfy the increasing bandwidth requirements. The NSF sponsored the formation of regional networks to afford network access to the research community. Typically, a campus is connected to a regional network which in turn is connected to the NSF backbone. The extent of the Nsfnet can be seen in Figure 7.2. The numbers used to label the sites are the Internet Network Designations. The regional network to which BNL belongs is Nysernet. In addition to Nysernet, BNL has a second high speed connection to the Internet via Esnet.

7.2.3 Nysernet

The acronym Nysernet stands for New York State Education and Research Network. The members of the network include 15 major New York State research universities and a number of smaller schools, BNL, IBM and Eastman Kodak; in the future laboratories at other leading industrial organizations will be joining. BNL is connected to Nysernet by a T1 line into NYC. The gateway between Nysernet and the NSF backbone is at Cornell which hosts one of the supercomputer centers. The network is interfaced to the CSCF Ethernet by a gateway and is accessible from any system on the BNL local network running TCP/IP.

7.2.4 Hepnet

Hepnet, previously called Physnet, refers to a network which has evolved to meet the needs of the high energy physics community. It is currently primarily based on DECNET and connects physics groups at universities and national laboratories in this country and abroad. It is one of the largest DECNET networks in existence. A number of eastern universities have leased line links to BNL, and BNL is in turn linked to the rest of Hepnet. In its early days the Hepnet backbone consisted of low speed leased lines funded by individual high energy groups and labs. Currently, Hepnet traffic is carried over the Esnet T1 links, and

Hepnet as an entity is expected to focus on providing application level network services to the high energy and nuclear physics communities.

In addition to carrying DECNET, Hepnet also makes it possible for a user at BNL to access a variety of X.25 resources on the network; these resources include the data switches at BNL, Fermilab, SLAC and other labs. After connecting to the data switch at a remote site, the user can log onto any system on which he has an account. Some systems of interest which can be accessed in this manner are the VAX Clusters at Fermilab and the IBM system at SLAC.

In order to connect an asynchronous terminal to an X.25 network the intervention of a PAD (Packet Assembler/Disassembler) is required. A PAD makes the transition between the character at a time mode of operation of an asynchronous terminal and the packet mode required by the network. PAD services at BNL can be accessed in two ways:

1) From the GANDALF data switch by selecting class X25. This provides access to a hardware PAD acquired from the Telefile Corp. Initially the PAD is in Command Mode and if you enter *HELP* it will display a list of commands. Entering *PATH* in response to the CM prompt results in a list of network addresses and their mnemonic equivalents. Since an X25 address consists of from 12-15 digits, it is desirable that the PAD understand mnemonics. Currently the Telefile PAD is configured for 4 inbound channels and 4 outbound channels.

2) From one of the BNL VAX Cluster systems running PSI or PSI Access. This is a software package which emulates a hardware PAD and is installed on BNLCL1 and BNLCL3. As an example, to connect to the Fermilab MICOM data switch:

   $ *SET HOST/X29 FNALPS*

   To obtain a list of addresses type:

   X29SITES

For more information on VAX PSI see the DEC manual **PAD and MAIL Utilities Manual** which is available in the CSCF Manual Library.

7.2.5 Mfenet

This network provides the DOE energy research community with access to the Cray supercomputers located at the National Energy Research Supercomputer Center (NERSC) at Lawrence Livermore National Laboratory. Mfenet runs over Esnet and provides utilities to facilitate job entry, file transfer and printing for jobs run at the NERSC. Access to Mfenet is available from any VAX in the CSCF Cluster. A user logged on to the Cluster can get on-line HELP by typing HELP MFE.

7.2.6 Esnet

As a result of the increasing importance of networking to the programs it sponsors, the Department of Energy has established the Energy Sciences Network (Esnet). Use of Esnet is restricted to universities and laboratories participating in programs or using facilities funded by the DOE Office of Energy Research. Esnet is managed by a group at Lawrence Livermore National Laboratory (LLNL) operating out of the National Energy Research Supercomputer Center (NERSC). This group previously built and operated Mfenet.

Esnet connects the major national laboratories and a number of universities with T1 links, using CISCO routers as switching elements. In addition to IP, it also carries DECNET as a native protocol, so that all external BNL DECNET traffic is now carried by Esnet. Esnet has two gateways to the Nsfnet backbone, one on the east coast and one on the west coast. The bulk of BNL traffic to external traffic uses Esnet with the exception of hosts at institutions directly attatched to Nysernet. Having T1 connections to both Esnet and Nysernet provides the possibility of maintaining external network access in the case of a single failure. The current Esnet topology is shown in Figure 7.3.

7.3 Domain Names

Hosts on the Internet use domain style names. Typically each site administers a set of local names. BNL has set up a domain under the top level domain gov called BNL.GOV. Most of the host names at BNL take the form host.dept.bnl.gov, so that the Internet name for BNLDAG is BNLDAG.AGS.BNL.GOV. Those hosts which are available on a Lab-wide basis are referred to using a three level name, so that the CSCF machines use names of the form HOST.BNL.GOV, as in BNLCL1.BNL.GOV. While the full form of the name must be used from systems outside the BNL domain, inside the Lab system, managers can enable the use of shorter aliases, such as BNLCL1, BNLDAG, etc.

7.4 Electronic MAIL

The growth of electronic mail systems has been very rapid. In the early stages a user typically was able to interchange mail with other users on the same system or on another system supplied by the same vendor. As the importance of electronic mail increased, techniques were developed to transport mail between different networks and different operating systems. When a user sends mail between two dissimilar networks, one or more intervening gateway systems play a role in establishing a connection between these networks. Some of the material in this section is based on the publication *Electronic Mail At ANL*, which contains an extensive discussion of mail systems.

The details of a session in which mail is sent or received vary from system to system but certain features are usually present. The first step is to establish the recipient, where the recipient may either be a user on the same or another system or may be the name of a distribution list. Next, the user is prompted for a subject, and finally the body of the message is entered. The user often has the option of using a full screen editor to compose the message. Some systems also provide for a list of people to receive "carbon copies".

When mail arrives the user may receive a new mail message, if he is logged on, in addition to a notification at initial logon. After each message is read, it can be deleted or filed by the user in a "folder" or "notebook" for later retrieval (the terms are system dependent). Some systems are able to construct the return address for a reply after a message has been read.

The three major routes for electronic mail at the Lab are DECNET, Bitnet and the Internet. The LABMAIL central mail distribution facility, which is described below, handles mail arriving at BNL from any of these three sources. Users can arrange to have their mail delivered to any system connected to the mail distribution machine by following a simple registration procedure.

A brief description of the major mail systems in use at the Lab follows. Perhaps the most confusing aspect of using electronic mail relates to the construction of the recipient's address. Some simple examples of addressing are given for each class of system, but users should consult the documents listed below for more details.

7.4.1 VAX/VMS

DEC VAX/VMS users employ the MAIL command to create, send and view electronic mail. The NEWMAIL folder serves as the VMS mailbox; users store their mail in the MAIL folder or other named folders they set up. VMS notifies electronic mail users through on-line messages when mail enters their mailboxes. VMS mail normally goes out over DECNET; the VAX/VMS systems that have TCP/IP installed can also directly access the Internet.

7.4.2 IBM VM/XA

Users on the IBM VM/XA can use either the Bitnet or TCP/IP based networks to communicate with other systems. The usual sequence is as follows: the MAIL command is used to initiate an electronic note, and the XEDIT editor is used to compose the note. CMS sends electronic mail to the appropriate virtual reader if the recipient is on the same system, or hands it over to the RSCS or SMTP virtual machine for delivery to a remote system. The RSCS machine handles Bitnet mail while the SMTP machine handles Internet mail. CMS notifies the recipient if the recipient is logged on when the message arrives. Users view electronic mail with the MAIL or MAILBOOK commands and store the message in a NOTEBOOK file.

7.4.3 UNIX

UNIX users use the mail command to create, send, and view electronic mail. Incoming mail can be stored in folders. The user can arrange to have mail forwarded to a preferred machine for receiving mail. UNIX notifies an electronic mail user through an on-line message when mail arrives. A logon message informs users if mail arrived while they were logged off. In general, UNIX has the most extensive set of mail handling facilities of any of the operating systems used at BNL.

7.4.4 Constructing Mail Addresses

Addressing mail to a recipient on a node on the same network as the sender is straightforward and adequately described in the on-line help files. When the recipient is on a different network the situation can be considerably more complicated. A number of systems at the Lab run multiple protocols and are thus able to function as mail relays. An algorithm is given in Figure 7.4 for constructing mail addresses from within BNL. This algorithm will provide the correct result for the most commonly used addresses. JNET refers to the VAX/VMS software needed for Bitnet access. Similarly, SMTP causes the mail to be directed to the TCP/IP software installed on the VAX/VMS Cluster.

7.4.5 LABMAIL

A central mail distribution service called LABMAIL is available at BNL. Its primary function is to make it easy for people, both on-site and off-site, to send electronic messages to people who work at BNL. Mail originating on any of the three principal external networks used to communicate with BNL: DECNET via Hepnet, Bitnet and the Internet, can be routed to your preferred machine for reading mail. In order to take advantage of this facility, you must register with LABMAIL, which is done by sending an electronic mail

message which consists of only two lines. The system from which you register will automatically become the system to which your mail will be forwarded.

To register for LABMAIL, logon to the machine where you prefer to read your mail and then send a short mail message to the user *REGISTER*. On the IBM VM/XA you would send the message to *REGISTER AT BNL*; on a UNIX machine, one would use the form *register@bnl*; and on a VAX/VMS machine one would use the form *BNL::REGISTER*. The first line of the message should be your real name; for example, *David Stampf* or *Stampf, David* (the case is not important). The second line should have a list of aliases such as *drs, stampf, stampe, stamp*. After you send this message, you will later be contacted to verify the information. This is primarily for security reasons. After the information is verified, you will receive a mail message telling you which names were acceptable to the LABMAIL system. Unfortunately, not all names are acceptable; for example, some computers reject names longer than eight characters. The first person to register a given name will have that name assigned to them. If a second person registers with the same name, the first person will have the digit 1 appended to the registered name and the second person will have the digit 2 appended (both people will be notified). Documentation on LABMAIL is available from the CCD Manual Library.

Users are strongly urged to register with LABMAIL and to give their LABMAIL addresses as their electronic addresses. By doing so, you can avoid the interruption of mail service which can occur if the names of BNL systems change or if you change the machine on which you normally read mail. A list of registered BNL LABMAIL users can be found in the yellow page section of the Lab telephone directory. If you send a mail message (a blank line will do) to *listing@bnl.gov* then the most current list of registered BNL LABMAIL users will automatically be sent back to your userid.

Contact the HELP Desk if you are already registered but wish to change your LABMAIL address.

The explicit form of the LABMAIL address a correspondent should use to reach you must be one of the following:

BNL:: your_name	If the sender is on DECNET
your_name AT BNL	If the sender is on BITNET
your_name@BNL.GOV	If the sender is on INTERNET

Further details about LABMAIL are contained in a writeup which is available in the CSCF Manual Library.

7.4.6 Examples

Constructing an address to send mail between users on the same network is straightforward and is adequately described in the basic manuals referenced in 7.5 below. The examples presented here will focus on sending mail between systems which do not share a common network protocol. The technique used in this case relies on sending the mail to an intermediate gateway system which understands both protocols.

Example 1. To send mail from a DECNET only node to a user named Jones on a system named DESTINY connected to Bitnet, use the address:

BNLCL1::JNET%"JONES@DESTINY"

Since BNLCL1 supports both DECNET and Bitnet, it is able to serve as a gateway; when the mail arrives at BNLCL1 the presence of the string JNET in the address causes the mail software to hand the message over to the Bitnet software for delivery to Bitnet node DESTINY. In this example BNLCL1 could be replaced by any local node supporting both Bitnet and DECNET.

Example 2. To send mail from a DECNET only node to a user named Jones on TCP/IP node DEV.CORNELL.EDU use:

BNLCL6::SMTP%"JONES@DEV.CORNELL.EDU"

In this case we are assuming that the VMS system BNLCL6 has the Multinet TCP/IP software installed. The presence of the string SMTP in the address causes the mail software on BNLCL6 to route the mail to Multinet for eventual delivery to the TCP/IP host. Any BNL VMS host running Multinet could be substituted for BNLCL6 in the address.

Example 3. To send mail from a UNIX system running TCP/IP only to Jones at Bitnet node DESTINY use:

jones%destiny.bitnet@bnl.gov

bnl.gov is a local UNIX system dedicated to networking support. It currently supports TCP/IP, Bitnet and DECNET.

Example 4. To send mail from a UNIX system running TCP/IP only to Jones at DECNET node DECNOD there are several possibilities:

a) *jones%decnod.decnet@bnl.gov*

This form is similar to (3) above with *decnet* in place of *bitnet*.

b) *decnod::jones@bnlcl6.bnl.gov*

Here we use *bnlcl6* as a TCP-DECNET gateway. The IP address of any local BNL system running Multinet could be used in place of *bnlcl6*.

Example 5. The IBM VM/XA supports TCP/IP and Bitnet. To send mail from the IBM system to Jones at DECNET node DECNOD use the form:

JONES%DECNOD.DECNET@BNL.GOV

Note that this is identical to 4a above.

7.5 Additional Information

A user needs much more detailed information than has been presented above to use the various networking facilities.

Additional information is available both on-line and in the documents which are available at the CSCF Manual Library.

VAX/VMS

Useful documents:

DECNET	Guide to Networking on VAX/VMS
MAIL	Mail Utility Reference Manual
TCP/IP	Multinet User's Guide
Bitnet (on BNLDAG)	Jnet User's Guide

On-line information:

On CSCF Cluster:	HELP MAIL, HELP TCP, HELP FTP, HELP TELNET, HELP MFE

On BNLDAG there are a number of useful documents in the directory BNL$MANUAL. Three particularly useful files are:

BNL$MANUAL:BITNET.MAN

BNL$MANUAL:GMAIL.MAN

BNL$MANUAL:BITNETNODES.MAN

In addition extensive HELP is available from inside GMAIL.

IBM VM/XA

Useful documents:

IBM TCP/IP for VM Command Reference Manual
IBM TCP/IP for VM Programmer Reference Manual

On-line HELP:

HELP MAIL, HELP MAIL MENU, HELP MAILBOOK

AID BITNET will result in a screen giving additional references.

When using FTP or TELNET TCP utilities entering ? or help results in a brief list of commands.

UNIX

The documentation for the UNIX system is kept on-line. To obtain information on a topic one enters

man topic

where topic could be mail, telnet, ftp, etc.

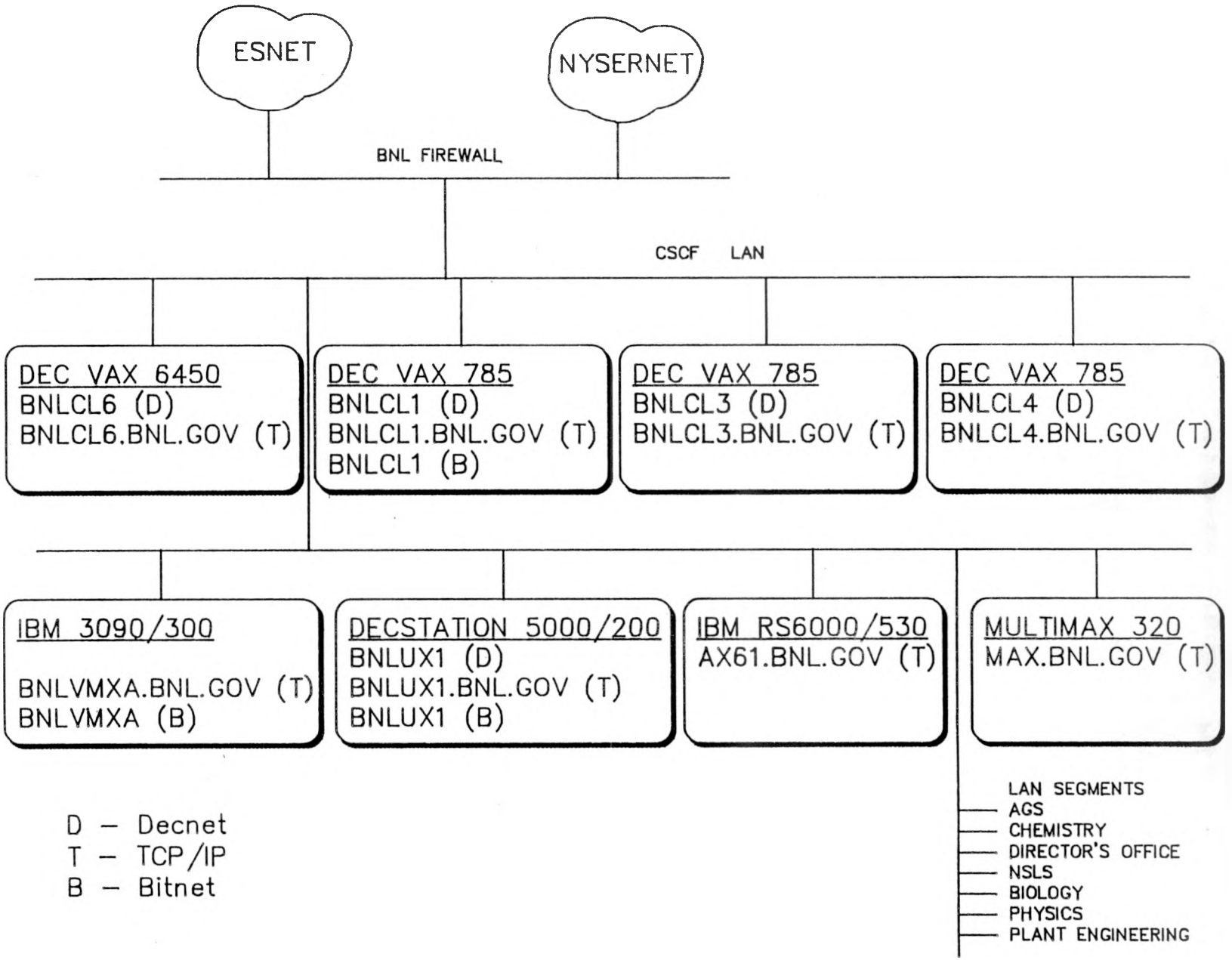


Figure 7.1
BNL Network Map

* Internal structure of networks (e g subnets) is suppressed.

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Figure 7-2 NSFNet Logical Connectivity – April 1987

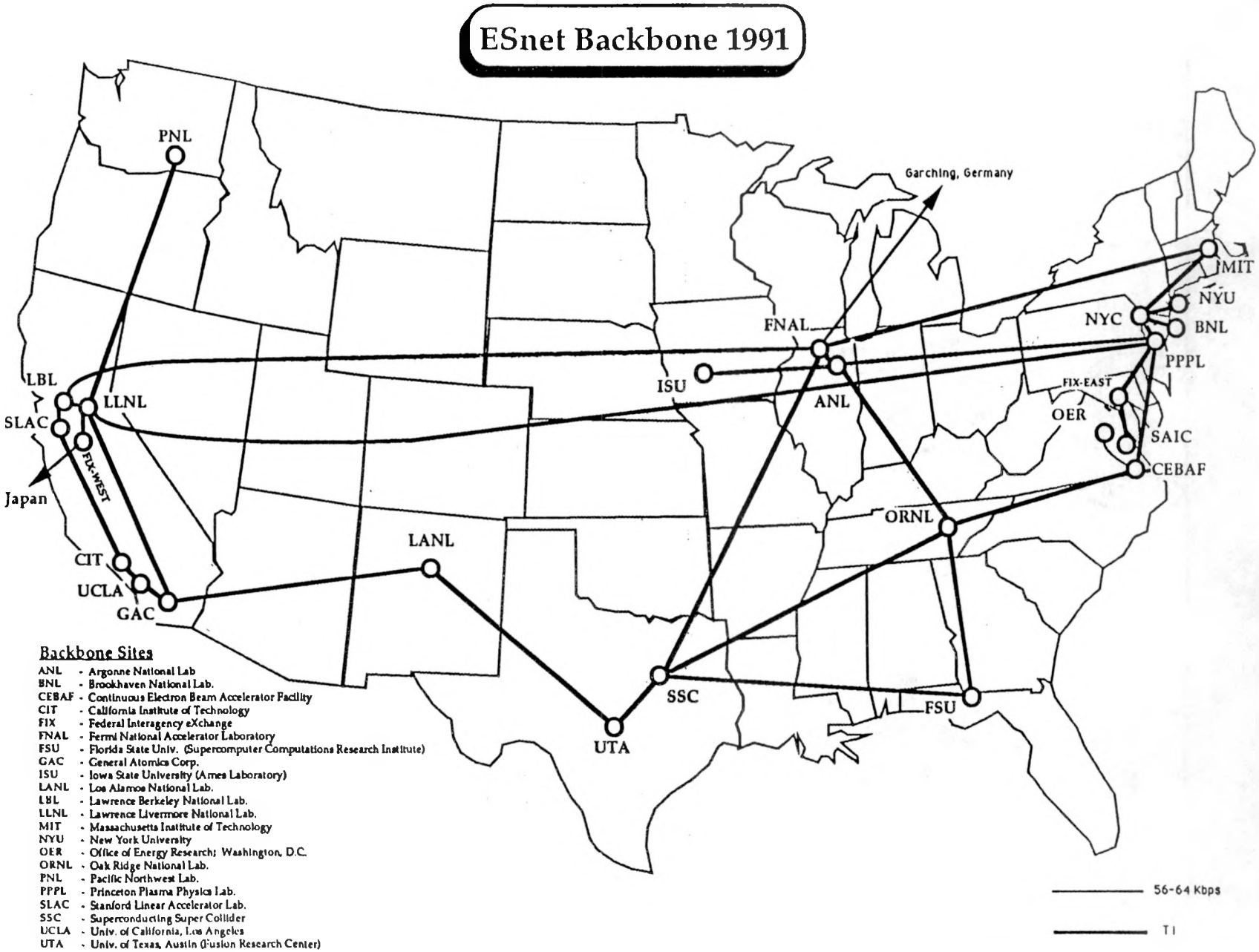

ESnet Backbone 1991
PNL
Garching, Germany
MIT
NYU
BNL
NYC
FNAL
PPPL
ISU
FIX-EAST
ANL
LBL
LLNL
SLAC
OER
SAIC
CEBAF
FIX-WEST
Japan
ORNL
LANL
CIT
UCLA
GAC
SSC
FSU
UTA
Backbone Sites
ANL - Argonne National Lab
BNL - Brookhaven National Lab.
CEBAF - Continuous Electron Beam Accelerator Facility
CIT - California Institute of Technology
FIX - Federal Interagency eXchange
FNAL - Fermi National Accelerator Laboratory
FSU - Florida State Univ. (Supercomputer Computations Research Institute)
GAC - General Atomics Corp.
ISU - Iowa State University (Ames Laboratory)
LANL - Los Alamos National Lab.
LBL - Lawrence Berkeley National Lab.
LLNL - Lawrence Livermore National Lab.
MIT - Massachusetts Institute of Technology
NYU - New York University
OER - Office of Energy Research; Washington, D.C.
ORNL - Oak Ridge National Lab.
PNL - Pacific Northwest Lab.
PPPL - Princeton Plasma Physics Lab.
SLAC - Stanford Linear Accelerator Lab.
SSC - Superconducting Super Collider
UCLA - Univ. of California, Los Angeles
UTA - Univ. of Texas, Austin (Fusion Research Center)
56-64 Kbps
T1

Figure 7.3

CONSTRUCTING MAIL ADDRESSES

From a VAX/VMS system:

To a BITNET node:

If originating node runs JNET software:

JNET%"USER@BITNOD"

Otherwise:

BNL::USER@BITNOD.BITNET"

To a DECNET node:

DECNOD::USER

To a TCP/IP node:

If originating node runs MULTINET software:

USER@FULLY.QUALIFIED.DOMAIN.NAME

Otherwise:

BNL::"USER@FULLY.QUALIFIED.DOMAIN.NAME"
(Note quotes in this case)

From a UNIX system:

To a BITNET node:

If originating node runs UREP software:

USER@BITNOD.BITNET

Figure 7.4
CONSTRUCTING MAIL ADDRESSES

Otherwise:

USER%BITNOD.BITNET@BNL.GOV

To a DECNET node:

If originating from a VAX/ULTRIX node running DECNET:

DECNET::USER

Otherwise:

USER%DECNOD.DECNET@BNL.GOV

To a TCP/IP node:

USER@FULLY.QUALIFIED.DOMAIN.NAME

From the BNL VM/CMS system:

To a BITNET node:

USER@BITNOD

To a TCP/IP node:

USER@FULLY.QUALIFIED.DOMAIN.NAME

Figure 7.4
CONSTRUCTING MAIL ADDRESSES

CHAPTER 8

PERSONAL COMPUTERS AND WORKSTATIONS

8.1 Personal Computer/Workstation Support

8.1.1 Acquisition

CCD offers support of certain IBM PCs and clones, as well as SUN and IBM RS-6000 workstations. (Refer to section 3.6 for a list of the supported equipment.) Acquisition of a Personal Computer requires an Implementation Plan approved by the Manager of ADP Acquisition (J. Denes, x-4101), followed by an Intra-Laboratory Requisition (ILR) to the CCD. The ILR should state the hardware options and software desired. CCD technical support personnel will acquire and configure the machine, install the operating system and other software ordered initially, and deliver a tested system to the end user.

8.1.2 Hardware

Typical configurations are recommended for the IBM PS/2 models, Apple Macintosh line, 386-16SX and 486-33 "AT" clones, SUN Microsystems and IBM RS-6000 computers.

Frequently installed options include:

- Network connections;
- Terminal connections;
- Memory expansion boards;
- Peripheral storage devices, e.g., SCSI disks; 1/4 tape; 8 mm helical tape, or CD ROM subsystems.
- Graphics adapters, e.g., Vega video7 VGA or VRAM, SUN "GX";
- Accelerator chips or adapters;
- Alternate monitors, e.g., NEC Multisync or Mitsubishi 19";
- Input devices, e.g., MS mouse, Hitachi 11" tablet or Trackball;
- Printers/plotters, e.g., HP Laserwriter/Deskjet, QMS laser, HP pen plotter.

For consultation on the appropriate configuration for your application, call Ted Daniels, x-5555, for workstations and Don Litcher, x-7587, for PCs.

8.1.3 Software

The "Computer Store" in the CSCF has distributed copies of over 800 different programs since it opened in 1984. Some of these may be tested by potential users either on their own machine, or the demonstration machine in the workstation demo room. A stock of the more popular shrink-wrapped programs for both PCs and workstations is maintained, others will be ordered on request. Purchase is via ILR. The CCD welcomes users' recommendations for PC software; however, we do not have the personnel to run comparative evaluations or make authoritative recommendations.

PC software sales are recorded in a data base, so we can furnish a user with a list of all people who purchased a specific program and who may be willing to serve as consultants in its use.

Laboratory policy strictly forbids the duplication of proprietary software or documentation and its use in any way not in accordance with the Licensing Agreement.

An up to date list of programs and *Notes for New PC Owners*, useful to those just setting up their PC, can be obtained from the Manual Library, x-4144.

Key people in the PC area are:

		Ext.
Kurt Fuchel	PC Software Support	4116
Don Litcher	PC Hardware Support	7587
Ted Daniels	Workstation Support	5555
Gordon Smith	Graphics Support	3216
Lou Potter	PC Store	4127
Michelle Cummings	PC Training	2077

8.2 Engineering Systems -- CAE/CAD/CIM (Computer Aided Engineering/Design & Integrated Manufacturing)

8.2.1 Overview

The BNL engineering community was introduced to specialized CAD systems for electronics applications in the late 1970s. In 1984, the Laboratory, under the guidance of the CADCAM steering committee consisting of leaders of the various engineering sections, launched a concerted effort with the primary purpose of obtaining modern design tools and coordinating CADCAM on a Lab-wide basis. These tools were to be easily available for everyone from the casual user to the serious designer or engineer. Since then CADCAM has increased from a handful of users in one division

to several hundred located throughout the Laboratory. A central support staff provides training, support with problem solving, standards and procedures, system integration and database management in a coordinated approach to the Lab-wide CADCAM system.

The BNL CADCAM system is networked throughout the BNL campus using its own TCP/IP subnetwork and a hierarchy of NFS servers for library and drawing file support, plotting and sharing engineering information among design groups and between Central Shops for fabrication.

The support of various CAD databases and their easy access in a consistent manner, the creation of standard parts libraries and procedures, and overall system integration in an organizational context is still under development.

8.2.2 Support and Maintenance

Regular courses are organized to train people in the use of CADD tools. BNL is established as an official training center for AUTOCAD and PCADs, two of the most popular applications supported on site. Instructors are brought in to the on-site training facility from SUNY Farmingdale to teach AUTOCAD and a BNL certified instructor teaches PCADs on a regularly scheduled basis. Additionally, training manuals, documentation, tutorial disks and videotapes, and other audio-visual aides are available from the PC store or through the CCD library. This library is also a source for newsletters, magazines as well as books maintained for use by BNL CADCAM users.

CAD designers, draftspersons, technicians and engineers require continuous support. The support team provides ongoing consulting services for users, maintains production hardware and software, and coordinates user/vendor liaison activities directed at enhancing productivity while maintaining established BNL standards and practices. Computer operations provides support for plotting, backup and archiving. Demonstrations and one-on-one tutorials on any of the five central workstations are also provided on request. Chris Neuberger, at x-7152, should be contacted if you would like to schedule time.

The CCD workstation demo room sets the stage for evaluation of CADD applications, and tutorials that are provided on request. Curt Bergh, at x-7152 will be happy to schedule time on any of the shared machines.

8.2.3 CAD/CAE/CIM Resources

CAD/CAM System

A networked SUN workstation running supported CAD/CAM applications is the Laboratory standard engineering configuration. By providing networked resources such as license and file services throughout the local BNL network, the engineer can benefit from localized workstation performance without the burden of administering the data or supporting other network resources such as plotting. Another benefit of this model is the amortization of large ticket items such as archiving storage systems, laser production plotting and software support. CCD administration of engineering information, eliminates the system and data management overhead costs for designers and engineers and meets the Quality Assurance objectives at the Laboratory.

8.2.3.1 Drafting and Design Documentation

AUTOCAD is used extensively (>200 licenses) for 2- and 3- dimensional design at the Laboratory. Pervasive as the major tool for mechanical design documentation, it is also used in Plant Engineering for facilities management and plant design.

8.2.3.2 Electronics Schematics and PC Board Design

PCADs offers modules for schematic entry, physical layout and routing. It can be found throughout the site (over 100 licenses) and is in the process of migrating from the PC to the workstation.

8.2.3.3 Conceptual Design and Analysis

SDRC - Ideas for Engineering is used by the BNL mechanical engineers early in the design process to conceptualize and simulate structural designs before documentation or fabrication.

CHAPTER 9

FILE STORAGE AND EXCHANGE

9.1 Disk Files

9.1.1 IBM 3090-300E Under VM/XA

A file is designated by a unique 3-part label called the *filename, filetype* and *filemode*. The filename and filetype can be 1-8 letters or digits. The filemode consists of a letter (A-Z) which denotes the minidisk on which the file resides, followed by a digit (normally 1) which indicates an attribute of the file. The filetype is used to designate the type of file; examples are: FORTRAN, EXEC, and TEXT (which in IBM terminology indicates an *object* file rather than textual material).

For example:

MYPROG FORTRAN A1	(Fortran source program)
MYPROG TEXT A1	(Compiled object code)
PROFILE XEDIT A0	(A0 mode indicates a hidden file)

CMS currently does not have a directory system; all files reside in areas called minidisks. A user can have several minidisks. The filemode of a file identifies the minidisk on which it resides.

9.1.2 VAX/VMS

In VAX/VMS, each user's files are organized into a tree-structured hierarchy of directories.

The full designation of a VAX/VMS file is as follows:

node::device:[directory]filename.type;version

For example:

BNLCL3::2DUA7:[SMITH]MEMO3.DOC;3

indicates that the file is on VAX/VMS Cluster node 3, on device 2DUA7 in the SMITH directory, is called MEMO3.DOC (the DOC indicates that it is a DOCument type of file), and is version 3.

If the file resides in the user's current directory, then only filename.type;version is necessary; if version is omitted, the highest one is used.

Details on VAX/VMS file designation can be found in the VAX DCL Dictionary.

Use PURGE or PURGE/KEEP=n to eliminate lower numbered versions.

9.1.3 UNIX

In UNIX there are three types of files: special files, directory files and ordinary files. Printers, terminals and tapes, etc. are examples of special files. Ordinary UNIX files are strings of bytes with no predefined structure. As a result, ordinary UNIX files may be easily transferred between UNIX systems.

In UNIX, all files are organized into a single tree-structured hierarchy of directories. Directories are branches, files are leaves. A file can be located by tracing a chain (called a "path") of directories leading to the file's location. Thus a file may be referred to by its name alone (once the path is established) or by its name preceded by the directory path with which it is associated. For example, user Brown may refer to file "myfile" or to "/u/brown/myfile", where brown is the default directory assigned to user Brown at login.

The full designation of a UNIX file is as follows:

host:/directory path/filename

For example:

ax61:/u/smith/memo3.doc

indicates that file memo3.doc is in user smith's directory on host ax61 (this is the CCD RS/6000 AIX system). Note that the suffix ".doc" is part of the file name; there are no formal file extensions in UNIX. Note, also, that file names are case-sensitive in UNIX.

On-line documentation is available for most commands on the system. For example, to read the *man*ual for the *ls* command, one would type *man ls*.

9.2 File Transfer Via Bitnet

Bitnet is an IBM based network facility that uses the RSCS protocol. Currently the only local machines that support this protocol are Cluster node BNLCL1, BNLVMXA, BNLDAG, BNLCHM and the BNLUX1 machine.

9.2.1 Between IBM VM/XA and VAX/VMS

IBM VM/XA to DEC VAX/VMS

Use the SENDFILE command on the IBM to copy a file from the IBM VM/XA to any VAX/VMS machine that supports RSCS. For example, to send file *TEST FILE A* to user DEMO on Cluster node BNLCL1:

SENDFILE TEST FILE A TO DEMO AT BNLCL1

On-line documentation on the IBM VM/XA can be accessed by typing:

HELP SENDFILE

When the file is received by the VAX/VMS machine, the VAX user should type *RECEIVE*; the prompt **RECEIVE>** will be displayed. One can then issue *RECEIVE* * to receive all files or *RECEIVE TEST FILE* to receive the individual file. For additional information, type: *HELP RECEIVE* on VAX/VMS.

DEC VAX/VMS to IBM VM/XA

Use the SEND command to transfer a file to the IBM VM/XA from any VAX/VMS machine that supports RSCS. For example, to transfer *TEST.DAT* from BNLCL1 to user DEMO on VM/XA, type:

SEND/FILE TEST.DAT DEMO@BNLVMXA

The file *TEST DAT* will be sent to user DEMO's virtual Reader on the IBM VM/XA. User DEMO should then issue a RECEIVE command to transfer the file to his minidisk.

For on-line documentation on the VAX/VMS; type:

HELP SEND FILE

9.2.2 Between IBM VM/XA and UNIX

IBM VM/XA to UNIX

Use the SENDFILE command to copy a file from VM/XA to any UNIX machine that supports RSCS. For example, to send file *TEST FILE A* to user DEMO on BNLUX1, type:

SENDFILE TEST FILE A TO DEMO AT BNLUX1

On-line documentation is on the IBM VM/XA, type:

HELP SENDFILE

UNIX to IBM VM/XA (or to DEC VAX/VMS)

On a UNIX host that supports the Netcopy facility which uses RSCS to send files to another Bitnet node, use the following command:

netcopy userid@nodeid if=local_file name=file.type

local_file is the name of the UNIX file to send and *file.type* is the remote file name and type.

In general, it may be better to use the MAIL or FTP facilities in preference to using Bitnet.

9.3 File Transfer Via FTP (File Transfer Protocol)

FTP is a networking facility that uses the TCP/IP networking protocol. The TCP/IP networking software is installed on the VAX/VMS Cluster, the IBM VM/XA, UNIX systems and on many other computers around the Laboratory. With this software, it is possible to transfer files between hosts on the Ethernet which support the TCP/IP protocol. On-line documentation is available on the VAX Cluster and IBM VM/XA by typing:

AID FTP

For example, to transfer files from a UNIX machine to the IBM VM/XA, one must know a legitimate user name and password on both the sending and the receiving system.

1. Login to the UNIX machine.

2. Enter *ftp bnlvmxa.bnl.gov* (which can be abbreviated to *ftp bnlvmxa* when transferring from a local node).

3. When the **Name** prompt appears, enter the IBM userid (if the same as the name logged in on UNIX, just press the return key).

4. Enter the IBM password in response to the prompt.

5. If all is in order, the prompt **ftp>** will appear.

6. When sending files to some remote systems (for example, the IBM VM/XA) you must supply a disk password. Use the command *ACCOUNT password* to specify the disk write password. An account password is not needed when sending files to the VAX Cluster.

7. Enter: *send local.name remote.name*, where *local.name* is the UNIX file name, and *remote.name* is the IBM fileid to be used on the receiving system. If the UNIX file name does not have a file type (i.e., is not of the form *name.type*) then the IBM file name MUST be supplied in the form *filename.filetype*.

8. When transfer completes, and **ftp>** appears, type *quit* to exit.

The IBM VM/XA can also initiate the FTP utility. Further information can be obtained by typing *HELP FTP*.

9.4 File Transfer Via MAIL

The MAIL facility can be used to transfer a file from one Internet node to another. In the following examples fn, ft and fm denote filename, filetype and filemode, respectively. Examples of Internet addresses are:

bnlcl6.bnl.gov	(for Cluster node BNLCL6)
ax61.bnl.gov	(for the CCD RS/6000) and
bnlvmxa.bnl.gov	(for the IBM VM/XA).

From UNIX, use the command:

mail userid@internet_address < fn

From VAX/VMS, use the command:

MAIL
SEND fn.ft

TO: *SMTP% "userid@internet_address"*

From VAX/VMS to another DECNET node, use the command:

MAIL fn.ft userid

From IBM VM/XA, use the command:

MAIL userid AT internet_address (FILE fn ft fm NOEDIT)

where *NOEDIT* specifies that the file is to be sent directly without editing.

9.5 Tape Interchange

VAX/VMS to IBM VM/XA

EBCDIC coded 9-track tapes or 8-mm tape cartridges can be generated for use on the IBM VM/XA. Tapes should be unlabelled. The CCD library, PUBLICFILES, contains a tape conversion utility that will generate EBCDIC tapes. Information on how to invoke this utility through PUBLICFILES is available on the VAX by typing:

AMD_INFO MAG_TAPE_USAGE CONVERSION_UTILITIES

IBM Tape Documentation

Basic documentation on 9-track tape or 8-mm tape cartridge usage and file formats is available on the IBM VM/XA by typing *AID TAPE* or any of the following:

HELP SETUP	or	HELPRINT SETUP
HELP FILEDEF	or	HELPRINT FILEDEF
HELP TAPE	or	HELPRINT TAPE
HELP TAPECOPY	or	HELPRINT TAPECOPY
HELP DISKIT	or	HELPRINT DISKIT
HELP BLOCKIT	or	HELPRINT BLOCKIT
HELP TAPEIT	or	HELPRINT TAPEIT
HELP TAPEMAP	or	HELPRINT TAPEMAP
HELP MOVEFILE	or	HELPRINT MOVEFILE

HELP displays to the screen and *HELPRINT* sends the information to the IBM printer. There are additional documents, help files, and subroutines for use in specific applications.

9.6 Personal Computers and Mainframes

A number of programs exist which allow a PC to communicate with other computers. Some are highly sophisticated, allowing many options to be set, others emulate a popular type of terminal. They all allow file transmission over the link.

The following programs are available from the CCD Manual Library; others will be ordered as they become available:

RELAY GOLD	Ideally suitable for access to IBM VM/XA
Smarterm 240	Flexible and powerful
REFLECTION	Emulates Hewlett-Packard terminal
PC/Intercomm	Easy to use, powerful
CROSSTALK XVI	Flexible and powerful
REXXTERM	Uses the IBM REXX language

The KERMIT protocol, which is supported by all of the above mentioned packages, allows transmission of *binary* as well as text (ASCII) files.

CHAPTER 10

GRAPHICS

10.1 Software Packages

Packages available on the VAX/VMS Cluster are: DISSPLA, (versions 10.0 and 11.0), and MAPPER which allows construction of graphic arts type figures by the use of an input file containing English-like commands.

On the IBM VM/XA, the only supported graphics package is DISSPLA, version 11.0.

10.2 Output Devices

A number of graphics plotting devices are available to the user. Device accessibility may be computer dependent. The user should consult the documentation noted below to verify device availability and access procedures.

10.2.1 COMp80

The COMp80 is a computer output microfilm recorder operated by the Photography and Graphic Arts Division. The COMp80 is capable of producing several different film formats, one of which is chosen by the user at the time of job execution. Output generated for the COMp80 is automatically dumped to magnetic tape and taken to Graphic Arts daily. Turn-around time is typically 24 hours (except weekends). Cameras available on the COMp80 include:

310mm full size (8.5 x 11 inches)
105mm fiche
35mm unsprocketed black & white
35mm sprocketed black & white
16mm sprocketed black & white

10.2.2 Black and White Laser Printers/Plotters

The Talaris 1590 PrintStation, Talaris-800 and QMS-2400 are laser printers with a resolution of 300 dots/inch. The Talaris-800 and the 1590 PrintStation are designated for small jobs and fast turn-around time with output on 8-1/2 x 11 inch Xerox paper. The QMS-2400 is a heavy duty laser printer capable of output on Xerox paper of size 8-1/2 x 11 through 11 x 17 inches.

The Apple LaserWriter II is a 300 dots/inch PostScript printer. It will print well-behaved PostScript documents. The Versatec model 8836 is a 36 inch wide laser plotter which provides a resolution of 400 dots/inch. The 8836 processes only files which contain Hewlett Packard Graphics Language (HPGL) commands.

All of these printers and the plotter are accessible from the VAX/VMS Cluster, the IBM VM/XA, and various workstations.

10.2.3 Color Printer

The QMS ColorScript 100 model 30 thermal printer provides color paper output at a resolution of 300 dots/inch. It will print well-behaved PostScript documents and is accessible from the VAX/VMS Cluster, the IBM VM/XA, and other computers connected to the Laboratory Ethernet.

10.2.4 Terminals

The Tektronix 4010 series is the principal type of graphics terminal that is supported on the IBM VM/XA. On the VAX/VMS Cluster several brands of graphics terminals are supported by the various graphics software packages. Refer to the on-line information facilities for more details.

10.2.5 Other Devices

There are a number of miscellaneous types of graphics devices available, such as line printers and pen plotters. Refer to the documentation noted below for details of availability or inquire at the HELP Desk.

The CSCF Ready Room provides a number of terminals and workstations for public use and evaluation. The equipment available changes to reflect computing capabilities. Equipment currently available includes a Tektronix color terminal with a 19 inch monitor and X-Terminal capabilities, a Macintosh IIfx, a DEC VT340 color terminal, and assorted brands of workstations.

10.3 Input Devices

A Hewlett Packard ScanJet Plus scanner is available for scanning images into IBM PS/2 or Macintosh personal computers. Contact the HELP Desk for details.

10.4 Documentation

The major documentation for any of the graphics software packages is, not surprisingly, the manual provided with the package. (Manuals are available from the CSCF Library.) Some packages also provide their own on-line help facilities. Additionally, there are often some local modifications made to these packages. Information on how to access and use a graphics package can be obtained by issuing the AID command, e.g., *AID DISSPLA*. The AID command can be issued from either the VAX Cluster or the IBM VM/XA. There is also a DISSPLA Conference in the CONSPIRE conferencing utility on the IBM VM/XA.

Additional information relating to graphics packages and plotting on laser printers can be found by issuing the commands

AID GRAPHICS and *AID LASER*.

CHAPTER 11

TELECOMMUNICATION SERVICES

11.1 Voice Service

The heart of the BNL telephone system is a GTE model GTD 4600E switch with a capacity of 9200 lines, of which approximately 4400 lines are currently in use. The switch provides an assortment of telephone features, from operator arranged conference calls (up to 11 parties), to station camp-on with call-back. A description of some of these features can be found at the beginning of the BNL Telephone Directory.

Various treatments (levels of access and restriction), appropriate to the needs of the user in the conduct of official business, are available as shown in Table 11.1. A list of the treatments and their description can also be found at the beginning of the directory. All treatments except VI and VII provide access to the BNL operator. Laboratory telephone operators are on duty from 8:00 AM to 6:30 PM during workdays.

BNL maintains a presence on the Federal Telecommunications System, FTS2000, which is the replacement system for the older FTS. It is expected that the price for FTS2000 services will eventually be considerably less than those of the old FTS. The AT&T MEGACOM WATS service will continue to provide inter-LATA calling for BNL until the expiration of the current contract in 1993. Current costs for the AT&T service average about 12.5 cents per minute. Access to FTS2000 is obtained by dialing **8** plus the 7 digit on-net number; dialing **9** plus 7 or 10 digits will direct the call to either NY Telephone or AT&T depending on the location of the called party. FTS2000 can be accessed from telephones with treatments 1, 2, 2A, 3, 3A and 9. Telephones in the apartment and dormitory areas cannot use FTS2000 service.

New installations, changes or disconnects relating to voice service must be requested by submitting an Intra-Laboratory Requisition (ILR) to the telephone office, Computing & Communications Division, Bldg. 179B, which will issue all orders to the telephone service providers. Any questions on voice service should be directed to the telephone office on x-2000. All telephone troubles should be reported to x-4031. All other calls to Federal Business Systems (FBS) can be made to x-4031.

A Radio Paging service also exists at BNL; see section 11.5 for details. Requests for radio equipment are made through the BNL Radio Shop, x-4243. Personnel there are familiar with the most current equipment, and they will be able to provide the equipment that you require. The Radio Shop also services all BNL owned radio equipment. There is no charge for this service unless an expensive part needs to be replaced. See section 12-4, Management of Radio Networks, for additional information.

Personal calls involving charges may be placed through the BNL operator. Use of this service will incur a minimum $.60 charge for the first call. Calls per month in excess of three will incur an additional service charge of $.20 each. There are also twenty-five (25) public coin phones located throughout the Laboratory site.

The Laboratory telephone directory is published annually. The most current information is available by dialing the BNL operator or the telephone office at x-2000.

11.2 Billing Procedures

The CCD bills each Laboratory Organizational unit monthly for its usage and distributes detailed charge reports generated from data taken from magnetic tape records of all off-site calls. Cost matrices for all common carriers providing service to BNL are supplied and periodically updated, under contract, by a software vendor.

A recent enhancement of the telephone switch permits telephone calls made from particular phones to be billed to the BNL accounts of different callers. The feature permits "class marking" a phone such that any valid 6 digit "Account Code" must precede each off-site call dialed from that phone. Account codes will be associated, in the billing calculation process, with valid BNL account numbers but for security reasons will not be simple derivations of BNL account numbers. Class marked phones will be designated as such by a sticker on the instrument.

Account codes will be assigned by the Telephone Service Office upon Departmental or Divisional request, designation of phone numbers to be "class marked" , and BNL account numbers to be billed. Account Codes are not linked to a particular phone and therefore can be used from <u>any</u> telephone to effect billing to the associated BNL account.

To use the Account Code feature, simply dial the 6 digit code followed by the off-site number. If the code is invalid, or no code is used, the caller will receive a tone indicating that service is unavailable.

11.3 Voice MAIL

A VMX-1000 voice mail system is in operation at BNL. The system is sized for 1000 users. A user can send, receive, scan, redirect, reply, save and erase messages. The system also has the capability for depositing messages directly into a user's "mailbox" when the phone is busy or not answered. Telephone subscribers who have Voice Mail service are denoted with an * in the BNL Directory. For more information about the voice mail facility call x-2000.

Treatments

All Treatments except VI and VII provide access to the BNL Operator.

Treatment I provides unrestricted access to:

- The FTS
- New York Telephone Operator
- All U.S. Area Codes
- 800 Numbers
- International direct distance dialing

Treatment II provides access to:

- The FTS
- All of Area Code 516
- New York Metropolitan areas 212, 718 and 914
- All other U.S. Area Codes
- 800 Numbers

Treatment IIA provides access to:

- The FTS
- All of Area Code 516
- New York Metropolitan areas 212, 718 and 914
- 800 Numbers

Treatment III provides access to:

- The FTS
- All of area code 516
- All of U.S. area codes except 212, 718 and 914
- 800 numbers

Treatment IIIA provides access to:

- The FTS
- All of area code 516
- 800 Numbers

Treatment IV provides access to:

- The New York Metropolitan area which includes all of
- area code 212, 718 and 914
- All of area code 516
- 800 numbers

Table 11.1

Treatment V provides access to:

- Primary service in Yaphank area. (Includes all exchanges bordering Yaphank.) - see Suffolk County telephone directory
- 800 numbers

Treatment VI provides access to:

- On-site extensions only and can receive calls from off-site

Treatment VII is restricted to:

- On-site use only; placing and receiving internal calls

Treatment VIII provides access to:

- The Interexchange Carrier system only; these are residential phones in the housing area

Treatment IX provides access to:

- International direct distance dialing and is otherwise identical to Treatment II.

Table 11.1 (Continued)

11.4 TELEX, TWX, Facsimile Services

Telex, TWX, and centralized Facsimile (FAX) services are handled by Mail Room personnel located in Building 179B. The phone extension for the teletype operator is x-2547. A DEX 3200 sub-minute facsimile machine is used for transmission and receipt of official business. The Fax machine is available (unattended service) for reception only, at all times, 24 hours per day. An MCI-DDD terminal and a Western Union - DDD terminal are also used for both foreign and domestic transmissions. Official and personal money orders, personal telegrams and mailgrams may also be sent from this office. The numbers for the machines are -

Facsimile:	516-282-3000
	FTS-666-3000
Telex:	6852516 BNL DOE
TWX:	510-228-1291

The hours of the BNL Mail Room are 08:30 - 17:00, on working days.

CHAPTER 12

RADIO SYSTEMS

Radio services are provided by the BNL Instrumentation Division, Bldg. 535B.

12.1 Radio Paging System

Some employees carry pocket pagers with them so that they can receive short messages wherever they are in the area. Both Digital and Audio pagers are available. Digital pagers provide the telephone number of the calling party on an LCD display. The BNL Telephone Directory currently lists the four digit number of that person's pager in a separate pager listing.

If you wish to page someone from a BNL on-site telephone, dial x-3456 and wait for a beep. If you get a busy signal the system is transmitting other paging calls; call back shortly or camp on. When you do get the beep, dial in the four digit pager number. You will hear a ringing signal followed by a series of beeps for several seconds. This is the acknowledgment signal that indicates that the selected pager is being signaled. You will have approximately 20 seconds to send a voice message or key in a telephone number after the acknowledge signal ends.

Occasionally, after you enter the pager number you will hear the paging system "ringing". This means that you are holding in a queue and that the pager you have selected will be signaled as soon as a current page is completed. Hang on until you get the acknowledge signal and proceed as explained above.

Radio pagers may be received off-site as well. The radio pager is a VHF system with a range of 15 miles from the Laboratory site. Remember, though, that the range will be smaller if a pager is shielded by a hill or by heavy construction. When the pager is in a marginal signal area, the pager may trigger, but the voice message will not come through. This means that the party will hear the beeping and will realize that someone is calling him, but the voice message may not be received. So at long range the pager operates as a tone only pager, not as a tone and voice pager.

Some employees are encouraged to take their pagers with them off-site so that they may be paged. Check with your supervisor about this. In all cases, the BNL radio paging system should be used only for Laboratory business.

12.2 Security Network

The Laboratory maintains one repeater network and one simplex radio network for the BNL security operation. The security equipment is dual frequency so that personnel can utilize either network.

Security headquarters has the ability to monitor most of the other radio networks on-site. In case of emergency, Security can also patch two or more of the networks together so that persons operating on the different networks appear to be on the same channel. Users are reminded that when networks are patched together, a high degree of radio discipline is required. Transmit only when absolutely necessary, and have what you need to say well thought out. Keep your transmissions short and to the point. Wait about one second after you press the microphone button for the system to switch before you speak, otherwise the first word of your transmission may be missed.

12.3 Other Radio Networks

Fire Network

The BNL Fire Department uses a simplex frequency. They have other radios that permit them to communicate with off-site fire departments for the purpose of coordinating mutual aid.

The BNL ambulance is equipped with a Lab radio and a radio that can provide communications with County Medcom and the area hospitals.

Scientific Network

A wide coverage simplex VHF network is available for scientific communication purposes. The HFBR, Biology, Meteorology and Oceanography use this network. It is a shared network used for the support of scientific experiments.

Tandem Van de Graff Network

A low power, simplex hand-held UHF network is provided for radio communications in and around the Tandem Van de Graff.

National Synchrotron Light Source (NSLS) Network

Two UHF simplex frequencies are provided for radio communications in and around the NSLS. One of the two frequencies has an associated base station that enables communication in shielded areas of that facility.

Collider Accelerator Repeaters

Two UHF repeaters provide communications in and around the large Collider tunnels. These hand-held HTs are dual frequency units.

Two repeaters are used. The main repeater is the Emergency Calling channel. Normally all HTs will be monitoring this channel, or F1. When it is necessary for two or more users to transmit anything other than a very short message, the users will switch to the other repeater, or F2. This is called the working frequency. The use of two repeaters keeps the F1 frequency open for emergency communications while the F2 channel keeps the "chatter" on the main channel to a minimum.

Plant Engineering & Site Maintenance Network

A simplex VHF network is provided for the coordination and communications of the site maintenance personnel.

A UHF low power frequency for hand held units (HTs) is provided for critical operations where a dedicated channel is required for critical or emergency operations.

AGS Repeaters

Two VHF repeater systems are available for the physicists engaged in conducting experiments in and around the AGS. The repeater is used because of the highly attenuated radio signals involved due to the heavy shielding used at the experimental areas. The repeater permits hand held units (HTs) to communicate directly with other HTs. All HTs are dual frequency.

Two repeaters are used. The main repeater is the Emergency Calling channel. Normally all HTs will be monitoring this channel, F1. When it is necessary for two or more users to transmit anything other than a very short message, the users will switch to the other repeater, F2. This is called the working frequency. The use of two repeaters keeps the F1 frequency open for emergency communications while the F2 channel keeps the "chatter" on the main channel to a minimum.

RAP Network

The Radiological Assistance Program utilizes three VHF frequencies in support of their radioactive clean-up and monitoring activities. The frequencies may be used simplex, or with a portable repeater. This group has responsibility that encompasses the entire northeastern part of the country.

Digital encryption is available for this network. This enables team members to communicate and to transmit sensitive information without that information being received and being misinterpreted by the lay public.

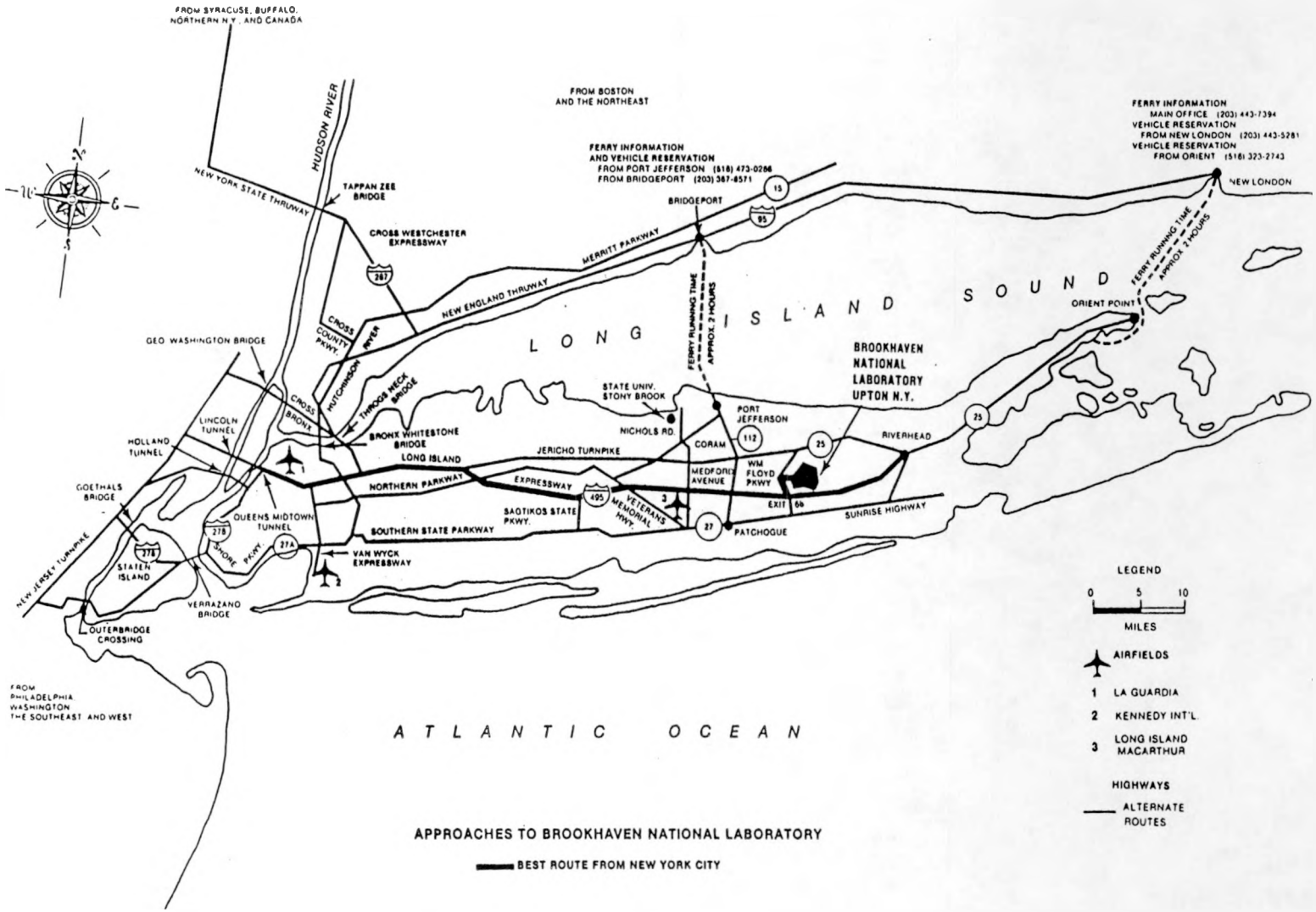
12.4 Management of Radio Networks

Management of the Laboratory's radio frequencies is the responsibility of the BNL Radio Officer. The Laboratory must comply with the policies and regulations of DOE and other agencies concerning frequency authorizations, assignments and pertinent technical standards. We are not managed nor licensed by the Federal Communications Commission. The government's Interdepartmental Radio Advisory Committee (IRAC) manages all government radio frequencies while its counterpart, the Federal Communications Commission (FCC), manages the civilian frequencies.

No radio communication should be used when wire line communications can be realized. Radio capability should not be requested when other types of communications services can be utilized. The reason for this is that the radio spectrum is limited and precious.

It is illegal for government users to use the civilian frequencies unless it is required that government users communicate with the civilian users. When this is necessary, we must obtain an IRAC authorization to use these frequencies. Please note that it is illegal to use these frequencies for government to government communication. This includes the so-called Citizens Band frequencies. Under no circumstances should employees use these channels for work related projects.

No "spectrum dependent equipment" (that is fancy language meaning radios) may be purchased unless spectrum space is available and the equipment itself and its use will conform to the pertinent regulations and requirements. Purchasing will not place orders for radio equipment unless it is ordered by the BNL Radio Shop that is under the direction of the BNL Radio Officer.

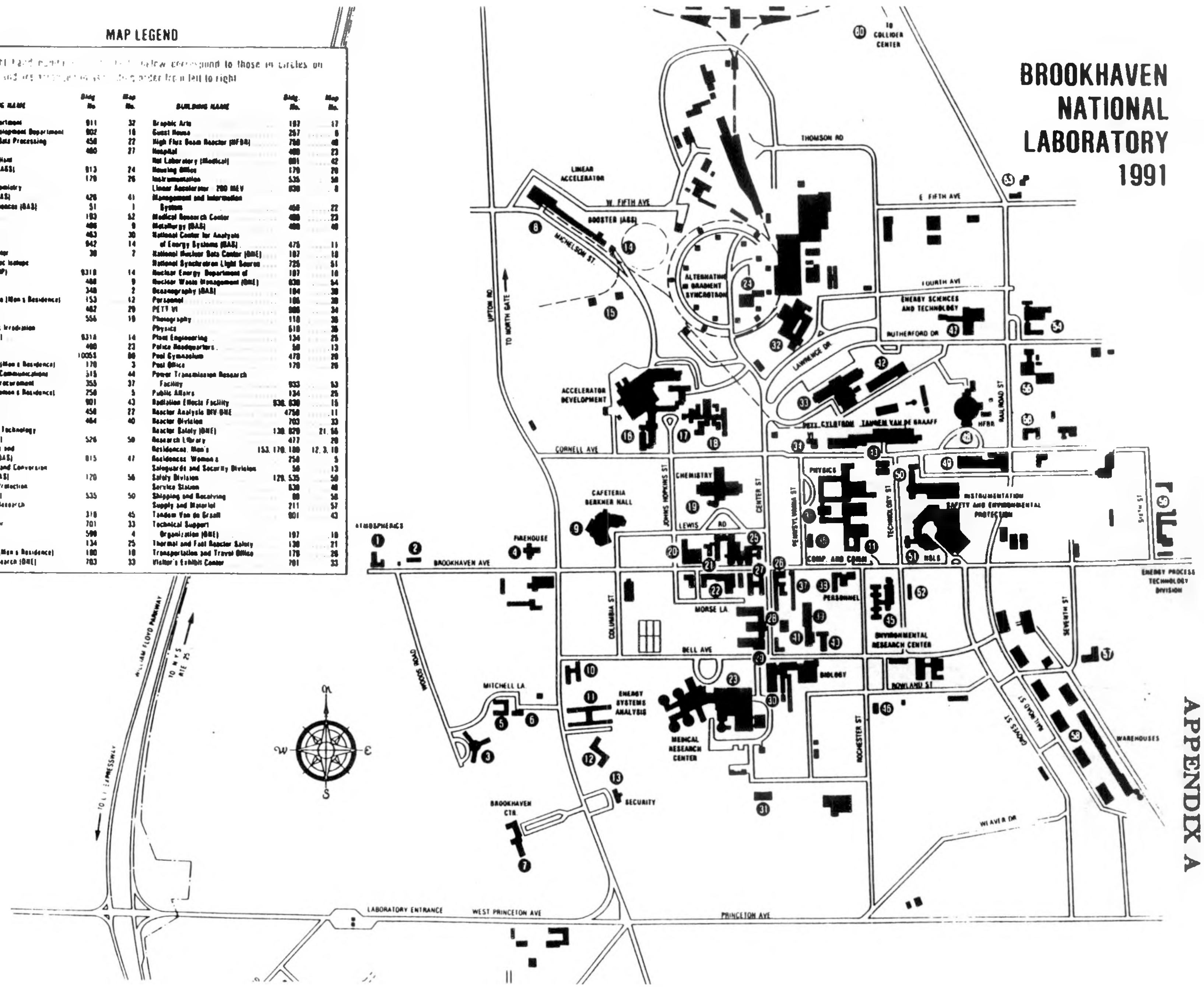


APPROACHES TO BROOKHAVEN NATIONAL LABORATORY

BEST ROUTE FROM NEW YORK CITY

APPENDIX A

BROOKHAVEN NATIONAL LABORATORY 1991



MAP LEGEND

The right hand numbers [illegible] below correspond to those in circles on the map and are [illegible] order from left to right

BUILDING NAME	Bldg. No.	Map No.	BUILDING NAME	Bldg. No.	Map No.
Accelerator Department	911	32	Graphic Arts	197	17
Accelerator Development Department	902	16	Guest House	257	8
Administrative Data Processing	458	22	High Flux Beam Reactor (HFBR)	750	48
Administration	460	27	Hospital	490	23
Alternating Gradient			Hot Laboratory (Medical)	801	42
Synchrotron (AGS)	913	24	Housing Office	179	20
Applied Science	170	26	Instrumentation	535	50
Atmospheric Chemistry			Linear Accelerator - 200 MEV	930	8
Laboratory (DAS)	426	41	Management and Information		
Atmospheric Sciences (DAS)	51	1	Systems	459	22
Bank	183	52	Medical Research Center	490	23
Berkner Hall	488	9	Metallurgy (DAS)	480	48
Biology	463	30	National Center for Analysis		
Booster (AGS)	942	14	of Energy Systems (DAS)	475	11
Brookhaven Center	30	7	National Nuclear Data Center (DNE)	197	18
Brookhaven Linac Isotope			National Synchrotron Light Source	725	51
Producer (BLIP)	931B	14	Nuclear Energy Department of	197	18
Cafeteria	488	9	Nuclear Waste Management (DNE)	830	54
Calibration	348	2	Oceanography (DAS)	184	39
Cavendish House (Men's Residence)	153	12	Personnel	185	38
Central Shops	462	29	PETT VI	906	34
Chemistry	555	19	Photography	118	38
Chemistry Linac Irradiation			Physics	510	35
Facility (CLIF)	931A	14	Plant Engineering	134	25
Clinic	490	23	Police Headquarters	50	13
Collider Center	1005S	60	Pool Gymnasium	478	20
Compton House (Men's Residence)	170	3	Post Office	179	20
Computing and Communications	515	44	Power Transmission Research		
Contracts and Procurement	355	37	Facility	933	53
Curie House (Women's Residence)	258	5	Public Affairs	134	25
Cyclotron	901	43	Radiation Effects Facility	930, 830	15
Data Processing	458	22	Reactor Analysis DIV-DNE	475B	11
DOE BHO	464	40	Reactor Division	703	33
Energy Process Technology			Reactor Safety (DNE)	130, 820	21, 55
Division (DAS)	526	50	Research Library	477	20
Energy Sciences and			Residences, Men's	153, 170, 180	12, 3, 10
Technology (DAS)	815	47	Residences, Women's	258	5
Energy Storage and Conversion			Safeguards and Security Division	50	13
and CPMG (DAS)	170	56	Safety Division	120, 535	50
Environmental Protection			Service Station	630	48
Division (S&EP)	535	50	Shipping and Receiving	98	58
Environmental Research			Supply and Material	211	57
Center (DAS)	318	45	Tandem Van de Graaff	901	43
Exhibition Center	701	33	Technical Support		
Fire Department	599	4	Organization (DNE)	197	18
Fiscal	134	25	Thermal and Fast Reactor Safety	130	21
Fleming House (Men's Residence)	180	10	Transportation and Travel Office	179	20
Gas Reactor Research (DNE)	703	33	Visitor's Exhibit Center	701	33

APPENDIX B
KEY PEOPLE AND TELEPHONE NUMBERS

CCD Telephone Numbers: (516) 282-xxxx, FTS 666-xxxx

		xxxx
Computing and Communications Division (CCD)		
Office	M. Kolomick	4109
Head	A. Peskin	4161
Deputy Head	G. Campbell	4168
Administrator	S. Rideout	4108
Quality Assurance, Safety, Security	M. Losquadro	7594
ADP Acquisitions	J. Denes	4101
Central Scientific Computing Facility (CSCF)		
Office	D. Fernandez	4103
Section Head	L. Lawrence	4107
Deputy Head	S. Sevian	7530
Operations Manager	A. Natoli	3976
Software Support	C. Saurino	4151
Systems Managers:		
IBM VM/XA	A. Smith	4122
VAX Cluster	P. Kessler	4156
VAX UNIX	M. Strongson	4192
IBM AIX 370 (UNIX)	E. McFadden	4188
IBM AIX RS/6000 (UNIX)	A. Como	7014
User Support		
Office	D. Fernandez	4103
Section Head	K. Fuchel	4116
Deputy Head	H. Berry	4152
Applications	A. Harris	4115
Graphics Support	G. Smith	3216
Education & Documentation	R. Wittlock	4112
HELP Desk	F. DeVito	4159
PC Store	L. Potter	4127
Manual Library	G. Taylor	4144
Distributed Computing		
Office	L. Dombrowsky	4132
Section Head	G. Rabinowitz	7637
Deputy Head/Networking	D. Stampf	4148
User Workstations & CAD/CAM	T. Daniels	5555
	E. Symonds	7126
PC and Workstations Hardware	D. Litcher	7587

Engineering and Telecommunications		
Office	L. Dombrowsky	4132
Section Head	R. Trondle	4171
Deputy Head	C. Pittenger	4128
Voice Communications	N. Pisco	2000
Data Communications	M. Torres	4199
Hardware Services	E. Brosnan	4114
Telephone Repair (FBS)		4031
Other FBS Business	T. Tully	5350
Radio Communications	S. Rankowitz (Instr. Div.)	4219
Additional Services		
HELP Desk		4159
CSCF Operations		4113
CCD FAX Machine		7688
Off-Site Data Services	G. Taylor	4127
Ready Room		4511
Telephone Information/Operators		Dial 0
Telephone Operators' Room		2123
IBM Systems Engineers	K. Hammer/R. Vaughn (IBM)	
7311		
Macintosh Center	M. Borowski (Custom Computer Specialists)	3895
PC Training	M. Cummings (MIS)	2077

APPENDIX C

PRIMARY REFERENCE MATERIALS

IBM VM/XA: (VM/XA stands for Virtual Machine/Extended Architecture)

SC23-0368	VM/XA CMS Primer
SC23-0354	VM/XA CMS Command Reference
SC23-0356	CMS User's Guide
SC23-0373	System Product Editor User's Guide (XEDIT)
SC23-0372	System Product Editor Command and Macro Reference
SC23-0375	Interpreter User's Guide (REXX)
SC23-0374	Interpreter Reference (REXX)
SC26-4221	VS Fortran V. 2 Language and Library Reference
SC26-4222	VS Fortran V. 2 Programming Guide
SC26-4223	VS Fortran V. 2 Interactive Debug Guide and Ref.

VAX/VMS

AA-D034D-TE	Programming in VAX Fortran
AA-D035D-TE	VAX FTN User Guide
AA-DF20A-TK	EDT Quick Reference Guide
AA-M477A-TK	EDT Quick Reference Manual
AA-Y500A-TE	Introduction to VAX/VMS
AA-Z300A-TK	EDT Editor Reference Manual
AA-Z421A-TE	VAX Utilities

UNIX

	BNL UNIX Users Manual Cornell UNIX Primer Individual manual sections are on-line Additional reference material on UNIX, C and the C-Shell, Bourne Shell etc. can be ordered from the CCD Manual Library.
SC23-2202	IBM AIX Version 3 General Concepts and Procedures
SC09-1257	IBM AIX XL FORTRAN User's Guide
SC09-1258	IBM AIX XL FORTRAN Language Reference
SC09-1259	IBM AIX XL C User's Guide
SC09-1260	IBM AIX XL C Language Reference

APPENDIX D

COMPUTER ACCESS LINES
GANDALF PACX (Private Automatic Computer eXchange)

Respond to Enter Class with either numeric or mnemonic code as follows:

Numeric Code	Mnemonic Code	S E R V I C E
-	ST	Machine Status and PACX Directory
111		XYPLEX Server autobaud
-	MFE	MFE Lab. CRAY
76	UNIX	CCD UNIX VAX
15		Meteorology VAX 11/750 autobaud
52		BNLDAG Versatec Printer, Bldg. 510
44		KA10 AGS Development System 2400 baud
11		Chemistry VAX
-	2-IPAP	MIS Inventory, Purchasing, Accounts Payable autobaud
-	2-JCARS	MIS Job Cost Accounting, Resource Sharing autobaud
-	2-SYSC	C-Machine, HP-3000, model 68 autobaud
-	2-USER	HP-3000, Series 70 Inquiry Databases
47		734 VAX autobaud
-	2-SYSA	HP 3000, model 3 autobaud to only 2400
-	2-SYSB	HP 3000, model 48 autobaud
17		CBA 11/60 9600 baud
35		NSLS Data General 9600 baud
77	LOOP	Loop Back
70		PC or terminal interconnect (1)
-	ID	Terminal address identification 1200 baud
-	DIAL	Autodial modems (6XXXXX + 9 + number)
24	IBMXA	IBM VM/XA autobaud 8 bit no parity
75	ENCORE/MAX	ENCORE MULTIMAX autobaud
170	ANNEX	ANNEX SERVER autobaud
-	AGS	XYPLEX Server autobaud
-	ADD/CHEM	XYPLEX Server autobaud
-	NSLS/HFBR	XYPLEX Server autobaud
-	PHY	XYPLEX Server autobaud
146	X25	X.25 PAD autobaud

(1) Terminal interconnect: one terminal, with terminal id nnnn, selects PACX class 70. Another terminal can then respond to the Enter Class prompt with T-nnnn, and the two terminals are connected. To determine the id number of one's terminal, select class ID with baud rate 1200.

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