Fermi National Accelerator Laboratory

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Providing a Computing Environment for a High Energy Physics Workshop

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Abstract

Although computing facilities have been provided at conferences and workshops remote from the host institution for some years, the equipment provided has rarely been capable of providing for much more than simple editing and electronic mail. This report documents the effort involved in providing a local computing facility with world-wide networking capability for a physics workshop so that we and others can benefit from the knowledge gained through the experience.

1 Background and Goals

Although it has become standard to provide access to computing facilities at high energy physics conferences, normally the access is provided via leased lines, resulting in sluggish response at the conference due to overloaded telephone lines as well as overloaded remote computers.

When Fermilab began planning the Physics at Fermilab in the 1990's workshop to be held in Breckenridge from August 15 to 24, 1989, it was decided to investigate providing enhanced computing capability. The workshop was intended to be a working meeting where significant computing and as well as word processing would need to be done, and the productivity of the attendees could be increased greatly by an improved computing capability. Therefore, in June, a committee was formed by Joel Butler, Associate Head of the Computing Department, to plan computing for Breckenridge. The members of the committee were Dan Green, head of the Physics Department; Cynthia Sazama, Accommodations Office; and the following people from the Computing Department: Shirley Jones; Judith Nicholls, User Support; Mark Leininger, User Support; Peter Cooper, Associate Head; Jack Pfister,

Associate Head; Phil DeMar, Communications Group; Darryl Wohlt, Communications Group; Dave Ritchie, DEC Systems; and Mark Haibeck, Field Maintenance. The committee drew upon many people, both within and outside of the Computing Department, to make and carry out the plans, and they are listed as authors of this paper.

2 Implementation

The general goal of the committee was to provide an away-from-home computing environment for a short period of time. The basis for a needs analysis came from experience at previous conferences, knowledge of the goals of the workshop, and a questionnaire sent out to all workshop registrants. The questionnaire included inquiries about the computing facilities the attendee would prefer (e.g., VMS, Macs), what other systems should be accessible, what kind of computing would be done, how much disk would be needed, what software packages would be required, and how much computer usage was expected. The results were tabulated and used as guidance.

It was concluded that the computing system would be needed primarily for MAIL, file transfer, remote login, calculations, graphics output, and word processing. Since a workshop is short, the attendees would need to be able to quickly start to use the system. After arrival, the attendees would need communications to get their local accounts ready for the workshop. The next stage would involve heavy computations by a rather large number of the attendees. As the workshop draws to a close, the emphasis would be on preparing transparencies for summary presentations and beginning to prepare the reports which would later be part of the proceedings.

Since this was a Fermilab workshop, the environment most familiar to most of the attendees would be the environment of the FNAL cluster. Also, in order to get real work done in the short time allowed, there must be a reasonable response time.

The committee decided that Fermilab would be able to provide some hardware and support for a local area VAX cluster for the workshop. The laboratory also made arrangements with Digital Equipment Corporation to provide equipment to be included in the LAVC, as well as demonstration equipment. Talaris Systems Incorporated provided several laser printers for the workshop. Regarding software, the goal was to clone the main Fermilab VAX cluster (FNAL) on the Breckenridge facility as closely as possible and reasonable.

A time-ordered overview of the computing effort might be itemized as follows:

1. Planning and arrangements at the workshop site

2. Negotiations with vendors

3. Building and testing the system at Fermilab

4. Tear-down and transportation to the workshop site

5. Setup and testing at the workshop site

6. Maintenance and support during the workshop

7. Tear-down and transportation home

Since the work was matrixed so heavily among the people involved, the following detailed descriptions of the effort are arranged by function.

2.1 Planning and Arrangements at the Workshop Site

Arrangements at the site were made by the Fermilab Accommodations Office. Although the office has helped arrange many Fermilab workshops and conferences, there were a number of details required for the computing facility that were different from the previous conferences. These differences are discussed in this section.

When a site is being selected, it is imperative that the person responsible for doing the ground work in the selection process be informed of exactly what type of computing facilities will be needed. Detailed information regarding square footage requirements, power requirements, number of terminals and Macs, listing of all equipment to be used, number of dedicated phone lines, etc., was obtained from the committee. Space for display of manuals, storage of supplies, storage space for the packing materials, and space for computer facility staff was also provided for.

Phone line requirements, electrical requirements, and total access availability of rooms to be used for computing facilities was contained in the written contract with the hotel. The phone lines, electrical power, and access to the rooms were scheduled for readiness (installation) at least one week before any equipment or computer staff was scheduled to arrive to install equipment. Phone lines must be ordered at least three months prior to installation date.

If the computing facility is to be available 24 hours a day, an agreement should be included in the contract regarding the provision of security personnel to monitor the computing areas when staff is not in attendance, either by hotel security or at the expense of the workshop.

Notices were sent out that all borrowed equipment should be clearly labeled with the owner's name and delivery location in order to facilitate the return of the equipment after the workshop. Each individual who agreeed to loan the equipment was responsible for preparing a Material Move Request for that equipment and scheduling delivery to Receiving for shipment. All the details about the equipment were thereby contained in a separate Material Move Request for each item.

A truck was rented to transport Fermilab materials and equipment to Breckenridge. Items were required to be in Receiving by August 1. The truck

was packed on August 3, left Fermilab in the morning of August 4, and arrived at Breckenridge on August 6.

The computer rooms finally selected were ideally located very close to the "center" of the conference activity. There was one large room and a small one for the public computing facilities, and another small one for DEC's demonstration equipment. The rooms had storage cabinets which were convenient for storing supplies.

2.2 Data Communications

The Data Communications Group of the Computing Department planned and implemented the communications portion of the Breckenridge workshop computing package, and assisted with some of the physical site planning and negotiations with Digital Equipment Corporation. Ethernet and AppleTalk LANs were used to provide local networking, and remote communications with Fermilab was carried out over a dedicated 56kbps digital circuit. Some dialup access was also made available.

A local Thinwire Ethernet joined three Fermilab-supplied Vax 3200's, four DEC-supplied VS3500's, two DEC-supplied VS3100's, two DEC-supplied DecStation 3100's, two Talaris-supplied Talaris 1590 printers, one Fermilab-supplied Talaris 802 printer, two DEC-supplied LN03 Postscript printers, three DEC200 8-port terminal servers, a DECrouter 2000 for the link to Fermilab, three Macintosh II's, and a Kinetics Fastpath Appletalk gateway.

The DECrouter 2000 routed DECnet traffic between the local ethernet and a 56kbps dedicated circuit to Fermilab. TCP/IP traffic was carried over DECnet using SRI Multinet software.

Twenty-Four DEC-supplied VT340 terminals were connected to the terminal servers for local and remote login services. Fermilab port selector access was accomplished using Vax PSI software to communicate (via X.29 protocol over DECnet, across the 56kbps line) with a packet assembler-disassembler (PAD) in Wilson Hall.

An Appletalk network connected six Macintosh SE's, six Macintosh Plus', a Laserwriter printer, and the Kinetics Fastpath Gateway. The Fastpath provided communications with the local ethernet, and allowed the ethernet- attached Macintosh II's to send files to the Laserwriter printer. The Macintosh II's could have been connected to both the Appletalk and ethernet media, but would not be able to communicate concurrently over both networks. Instead, the user would have to use Chooser to select one network or the other. The complexity of the user procedures was minimized by using an ethernet attachment full-time and providing a Fastpath.

Limited dialup access to the terminal servers was arranged using hotel telephone lines and V.22bis/MNP-5 modems supplied by both Fermilab and DEC. V.22bis allows a 2400 baud line speed, and MNP-5 provides error correction and 2:1 data compression (for an averaged throughput of 480 cps).

Approximately four months before the workshop, verbal quotes for the cost of installation and lease of the circuit were received from MCI and ATT. The lease agreement would cover the period of August 7 to 25, and include rental of a DSU/CSU (Data Service Unit/Customer Service Unit) for each end. MCI quoted $1418.00, $2052.00, and $160.00 respectively, and was chosen as the carrier. GSA Form 2936-A was obtained and filled out, as is usual when ordering a leased line. However, DOE informed Telecommunications that the form was unnecessary in this case because the duration of the circuit was less than one month.

The order called for an installation date of August 7, seven days ahead of the workshop starting date, to allow for trouble. MCI was contacted at regular intervals during the preceeding 3 months to reaffirm the installation schedule. The line was in place on schedule, but due to an MCI error, the Breckenridge end did not receive a DSU/CSU until late in the day August 7. The DSU/CSU's were connected August 8th, and after a 24-hour error rate test period, the circuit was turned over to us on August 9. MCI promised credit for the 2 days lost. The circuit itself performed well (i.e., maintained a low error rate) throughout the service period, except on August 15, the first day of the workshop, when all telephone service between Breckenridge and Denver failed for a few hours.

The DECrouter 2000 and a spare equipment shelf was mounted in the rack. Four DESTA-type thinwire transceivers were mounted for attachment to the three Vax 3200's and the DECrouter. The Kinetics Fastpath Gateway was to reside in the rack, but was shipped separately. An Emulex 32-port terminal server was also shipped as a spare unit to the DEC200's.

Vax PSI, SRI Multinet, and Jnet would be needed on the Fermilab LAVC in order to provide terminal access to the FNAL port selector (via X.29 using PSI), TCP/IP facilities (via Multinet), and Bitnet access (Jnet). The Data Communications Group arranged the appropriate software licensing extensions with SRI International and Joiner Associates.

Although it was intended to have a unique BITnet and DECNET name (FNCNF) for conference facilities, we were unable to obtain a BITnet nodename in time. However, there was a currently-unused Fermilab nodename which could be used for the conference – FNALA – which was also a DECnet nodename. The name did confuse people, however, because they tended to feel such a nodename must be part of the FNAL clusters rather than the LAVC at Breckenridge. If conferences with computing facilities are to be held frequently, it would be convenient to have a unique memorable nodename which could be used.

2.3 Hardware

The Field Maintenance Group was requested to construct the hardware and provide maintenance support at the conference.

The basic configuration was outlined at the first Breckenridge planning

meeting. To a large extent the configuration was determined by what was available in the way of uncommitted experimental equipment – three MicroVAX 3200's. One was configured as a boot node with 8mb of memory, a 150mb RD54, four Wren V disks for 2.5gb of storage and an 8mm tape drive. The two satellite nodes were similar except that they each had only one Wren V for 640mb of storage.

All of the equipment was assembled in a sixty inch Fermilab rack with wheels. Two 20 ampere power distribution strips were installed. The 20 ampere power strips utilize ordinary "office" type (L5-20) plugs. Use of two circuits distributes the load so to avoid problems with overloading the power circuits in the hotel.

The systems were built four weeks before the conference date. The schedule called for a week to construct and test the systems. The following three weeks were scheduled for software installation and reliability testing.

Knowledge of critical details often plays an important role in solving problems associated with a system. For good continuity a person who would go to Breckenridge was assigned all service operations during the three weeks previous to the shipment of the system. During the hardware test period there were only two minor hardware problems. Nevertheless, the technician spent a lot of time with the system observing the system installation work and learning about the system software.

With the system up and running, the job of preparing spare parts for shipment to the conference began. Each of the major subassemblies of the system were located, and then the spares were configured into a running hot spare system.

When shipping day came, the system rack was covered with cardboard sheets and loaded onto the front of the truck. The front of the truck was specified because it affords the smoothest ride. The spares were loaded onto the truck too.

The Field Maintenance technician was present at Breckenridge for three days – one day for installation of the system and two days to monitor and establish stable operation. Installation consisted mainly of connecting terminal and power cables and start-up was uneventful except for a minor power supply problem in the disk mounting chassis for the boot node. Because the technician had seen the problem during the testing before shipment he knew how to solve the problem quickly. There were no further problems with any of the systems during the following two days of normal system use. The technician then returned to the lab. The systems performed without any hardware problems for the remainder of the conference.

After the conference was over, the LAVC cables were disconnected and the equipment in packed the boxes that were used to initially ship the system. The system arrived back at the lab in good condition.

2.4 Systems

Basically, a Fermilab standard VMS V5.1-1 system and some DEC layered products were installed. The DEC layered products consisted of the majority of products which exist on the FNAL cluster. The version levels were matched to the version levels of FNAL when possible. Fermilab products included the batch daemon, site products, BULLETIN, FINGER, ALIAS, GMAIL, etc. Third party products installed included Jnet and SRI Multinet.

In preparation for the addition of DEC-supplied nodes, multiple user roots on one disk were created. Users were then assigned to the multiple user roots according to an expected disk size factor. A utility (originally developed by K. Chadwick) was used to copy authorization records from an existing VMS authorization file to another authorization file used by the conference cluster. The utility also created disk directories, disk quota entries, and can grant rights identifiers and other account management tasks if desired. This provided a secure method of establishing user accounts for this off-site event. All attendees with existing FNAL VAX Cluster accounts used their current FNAL password to access the conference cluster. The utility provides more security than just copying the current FNAL authorization file by establishing valid accounts for attendees only. During the process, no passwords were compromised since the copy utility copies the binary form of the authorization record. No known utility can decode the encrypted value of VMS passwords. Visitor account were created for non-Fermilab users.

At Breckenridge, the Fermilab system was first tested to insure that it had traveled well. Then Fermilab and DEC personnel worked together to add the DEC workstations to the LAVC. Then, the node-specific things for Jnet, Multinet, the batch daemon, and backup procedures were added. The user roots were then moved to the various disks and modified the appropriate system logicals to reflect the moves. Finally, the identifiers and project roots for the conference were added.

2.5 User Support

In the planning stages, we determined which products that were requested or likely to be used could be put on the system without special licensing. When licensed products were needed, arrangements were made with the vendors. Microsystems Engineering Corporation allowed us to use their MASS-11 product; Talaris Systems Incorporated provided several laser printers at the conference and allowed us to use their software during the workshop. Precision Visuals graphics software was covered by existing laboratory workstation licenses.

In general, many CERN products and other physics codes were provided, as well as commercial and physics-community graphics packages. The tools used for accessing the VM system at Fermilab were also installed. The word processing packages MASS-11 and TEX(LATEX) were provided.

After the system was set up at Fermilab, the selected products were in-

stalled and tested. A major experiment had requested a subset of their environment be included on the system, and this was installed on the disks at Fermilab.

Reference documentation was collected for the system and for the installed products, and was shipped with the hardware on the truck. A local users guide was developed, was modified heavily at Fermilab while the system was being put together at Breckenridge, and was also modified at Breckenridge. Since the workshop system would be very close to a clone of the Fermilab clusters, the guide was meant as a supplement to the Fermilab VAX Cluster User's Guide. The local guide described the system in general terms, described how to log in, how to use MAIL and NEWS, and how to print. Networking was a very strong point of the facility, and the guide told how to reach Fermilab computers, as well as other destinations.

At the conference, at least one person staffed the computing rooms during the day, and staff was available frequently, if for short periods, during the evening. An account with username CONSULT was instituted to be monitored in the consulting office at Fermilab during the day.

3 Cost

Digital Equipment Corporation provided the DEC equipment and for their staff. DEC also provided the security guard outside the Computing Facility, which cost about $1700. The shipment of all of our equipment, including office supplies and library, cost $3,900. The leased telephone line cost $3,630. The installation of the additional power capability required for the computers cost $1,989. We also paid $800 to get into the rooms prior to August 11. Computing staff costs were estimated at $4,500 for 2.5 staff members throughout the Workshop.

4 Evaluation

The LAVC worked beautifully, and the consensus was that having significant on-site computing capability greatly enhanced the effectiveness of the workshop.

The important features the LAVC provided as opposed to using leased lines exclusively were speed and the ability to use cluster if the data-line fails. The disadvantage compared to simply providing terminals and a leased line to an existing computer center is the increased cost and effort required to provide a local computing system. When deciding whether to provide local computing capability at a remote conference or workshop, the added benefit in terms of increased attendee productivity should be weighed against the additional effort and cost.

The actual building of the system at Fermilab is considered necessary, since all the Fermilab resources (hardware, software, and personnel) are available. A month should be allowed to put everything together.

The DEC staff was efficient, knowledgeable, and co-operative. The setup of DEC and Fermilab equipment went smoothly once the electrical power was in

place. The entire LAVC went together faster than expected. Since DEC provided Field Service on site, maintenance of the hardware was prompt.

The site selected for the facility should be inspected early and changes or additions made prior to the setup time period. We didn't get power into the computer room until Tuesday morning. No hardware changes should be made to the hardware after the initial configuration is up and running. We had several days of down time right at the end of the building period because we added additional disks and tape units.

Additional testing time at the remote site should be stressed. In the case of Breckenridge, the addition of six nodes to the cluster plus additional printers did change some things. It was not possible for those doing the setup to test everything, nor did we have adaquate knowledge of all products which required testing. An additional User Support person for a couple of days just prior to the start of the workshop may have helped. This would also imply a longer setup time be planned.

Having accounts already available and using existing account names and passwords for the Fermilab users was excellent. It greatly cut down on time spent having to setup a new account, and it was reassuring for the Fermilab users to use something they were familiar with. However, more planning should be done on the handling of user accounts. In particular, the adding of accounts for non-registered users was not as organized as it should have been. Also, a clear understanding from the beginning of the workshop of what was to happen to the user's files at the end of the workshop is recommended.

It is preferable to keep the type of terminals used to a minimum. The more different types of terminals there are, the more problems and questions people have. Terminal settings are frequently changed, confusing users as well as support people. There were a lot of problems related to the Macintoshes. Some problems were due to viruses, but some must have been due to the way they were linked to the LAVC. It would be preferable for the support staff to be familiar with the types of connections used and the software installed on them.

The printing capability was adequate, but we had a lot of trouble with the Talaris 1590 printers, which were a new and unfamiliar model. Clearly, consistent and familiar hardware and software is recommended throughout the facility.

A mail terminal with a slaved printer for 10 minute use only is a recommendation for future conferences. Even though there were about 40 terminals available for accessing the LAVC, there were a number of people waiting for a turn during the peak periods before the sessions, around lunch time, and in the early evening. The support staff found it necessary to set aside a workstation for staff use during most of the conference.

During the workshop, there were three user support people and one systems person available, but no communications person. Things went well, but we were light on communications knowledge and were reduced to fumbling around on occasion.

Although the environment was a near-clone of the one most attendees were

familiar with, people still needed to tailor their accounts, copy files, etc. and it took a few days before they were able to settle down to real work. We would encourage individuals and groups to do more preparation for working on the conference system, and recommend that conference organizers attempt to make this setup period, as well as the end-of-conference period, as easy and quick as possible.

It is important to be able to disseminate information locally. A local users guide was very useful, and it was necessary to update it on site. NEWS was also very useful in keeping people up to date. The conference secretariat needed to be educated as to how to use the facility to notify users of activities.

MAIL was very heavily used between support people at the conference and with the home institution. The CONSULT account turned out not to be necessary in our case, but there should be good contact with the home institution by some means.

Shipping the equipment in foam-packed cartons is not ideal, and we were very lucky that all of our equipment came through unharmed. If an organization is planning to have regular workshops where computer equipment is going to be shipped to another location, consideration should be given to purchasing or constructing shipping containers on wheels, with foam rubber lined compartments for monitors, keyboards, computers, cabling, connectors, power strips, extension cords, tools, etc. Also to be considered for purchase or construction are racks for computing printout.

4.1 Summary

The computing facility at Breckenridge has provided a standard for conference organizers to try to meet in the future. The project required close cooperation from all groups within the Computing Department, as well as cooperation with the Physics Department and the Accommodations Office. It was truly a broad-based effort, and it was satisfying to see the facility come into being, and to be so enthusiastically accepted by the workshop attendees.

4.2 Acknowledgements

We wish to thank Digital Equipment Corporation and the other vendors who provided hardware and/or permission to use software at the workshop.