Fermi National Accelerator Laboratory

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Providing a Computing Environment for a High Energy Physics Workshop

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Providing a Computing Environment for a High Energy Physics Workshop

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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 over leased lines. This presentation describes the pioneering effort involved by the Computing Department/Division at Fermilab in providing a local computing facility with world-wide networking capability for the Physics at Fermilab in the 1990's workshop held in Breckenridge, Colorado, in August 1989, as well as the enhanced facilities provided for the 1990 Summer Study on High Energy Physics at Snowmass, Colorado, in June/July 1990. Issues discussed include type and sizing of the facilities, advance preparations, shipping, on-site support, as well as an evaluation of the value of the facility to the workshop participants.

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 by providing local capacity. 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. The success of this computing facility led to the request that we provide computing facilities for the 1990 Summer Study on High Energy Physics at Snowmass, Colorado, in June/July 1990. Since Breckenridge was short on local computing power, and it seemed reasonable to attempt to augment the capacity with RISC UNIX boxes and use this opportunity to experiment with UNIX systems in a physics environment.

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[1]Operated by Universities Research Association, Inc., under contract with the United States Department of Energy

2. Implementation

For each workshop, a committee was formed composed of people from hardware, system software, communications, applications, and user support, keeping very close communication with the workshop organizers. The general goal of the committee was to provide an away-from-home computing environment for a short period of time. There is really nothing technically difficult about the task -- in fact it is almost completely a matter of logistics. All of the activities have to be coordinated, and the whole facility ready the first day of the workshop -- no slippage in the schedule allowed.

The basis for a needs analysis came from experience at previous conferences, knowledge of the goals of the workshop, and questionnaires sent out to 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 was planned, 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 be productive on the system very quickly. After arrival, the attendees would need communications with the home institution 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 to be put in the proceedings.

Since Breckenridge was a Fermilab workshop, we decided to provide a software environment similar to the main Fermilab VAX cluster (FNAL), which would be familiar to most of the attendees. The committee decided that Fermilab would be able to provide some hardware and the necessary support for a local area VAX cluster for the workshop. The laboratory also made arrangements with Digital Equipment Corporation to provide additional equipment to be included in the computing facility, as well as some demonstration equipment. Talaris Systems Incorporated agreed to provide several laser printers for the workshop.

Snowmass, however, would have attendees from all over the world, so we couldn't assume that they were familiar with our environment. Furthermore, we were adding UNIX to the suite of systems. Although we still made the VMS system very close in appearance to the FNAL cluster, we would need better documentation and more assistance on site.

For Snowmass, we again used equipment from Fermilab supplemented by significant equipment from vendors. Digital Equipment agreed to return with their traveling road show, Silicon Graphics agreed to bring their Molecular Modeling Lab, and Sun Microsystems agreed to provide a number of workstations. Talaris again provided printers.

The list below indicates a somewhat time-ordered overview of the effort. Because of the firm deadline (workshop start date), there had to be well-adhered-to milestones during the preparations to make sure the project was on track. This would have been a good project for a project management tool, but we didn't use one.

1. Planning and arrangements at the workshop site
2. Negotiations with vendors
3. Building and testing at least a subset of the system at Fermilab
4. Tear-down and transportation to the workshop site
5. Setup, integration of vendor-supplied hardware, and testing at the workshop site
6. Maintenance and support during the workshop
7. Tear-down and transportation home

3. Planning and Arrangements at the Workshop Site

There are a number of arrangement details that are required for the computing facility that were different from previous workshops and 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 understand the space requirements, power requirements, air conditioning requirements, number of telephone lines required, etc. Space for display of manuals, storage of supplies, and storage space for the packing materials is also required.

Phone line requirements, electrical requirements, and total access availability of rooms to be used for computing facilities were contained in the written contract with the hotel. It is probably necessary for computing personnel to visit the site in advance to understand the details of the setup. A certain amount of creativity may be needed. For example, DEC came prepared to use the 220 volt power provided for the electric stove in the condo kitchens at Snowmass. The phone lines, electrical power, and access to the rooms were scheduled for readiness (installation) at least one week before any equipment or computing staff was scheduled to arrive to install equipment. It is important to check early on the lead time required for telephone requests.

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.

The computer rooms should be located very close to the "center" of the conference activity. This was the case at Breckenridge, but the facilities at Snowmass were less ideal, both because the computing equipment had to be housed in four separate condos, but also because they were not as convenient.

4. Data Communications

The Data Communications Group planned and implemented the communications portion of the workshop computing package. Because of the importance of the communications links at a workshop such as these, communications personnel should be at the site for the duration of the workshop.

Ethernet was used to provide local networking, and remote communications with Fermilab was carried out over a dedicated 56kbps digital circuit in the case of Breckenridge and a 1.5 mbps (T1) circuit in the case of Snowmass. An Appletalk Macintosh network was also available.

Although it was intended to have a unique BITnet and DECnet name (FNCNF) for the workshop facilities at Breckenridge, we were unable to obtain a BITnet nodename in time. The use of a currently-unused Fermilab BITnet nodename, FNALA, also a DECnet nodename, was confusing because users tended to think such a nodename must be part of the FNAL clusters rather than the system at Breckenridge. The name FNCNF was in place for Snowmass. It is convenient to have a unique memorable nodename for workshops and conferences.

The T1 link for Snowmass was nicknamed the "T1 link from hell." Although it was supposed to be installed a week before the workshop, it was a week into the workshop before it was working reliably.

5. Hardware

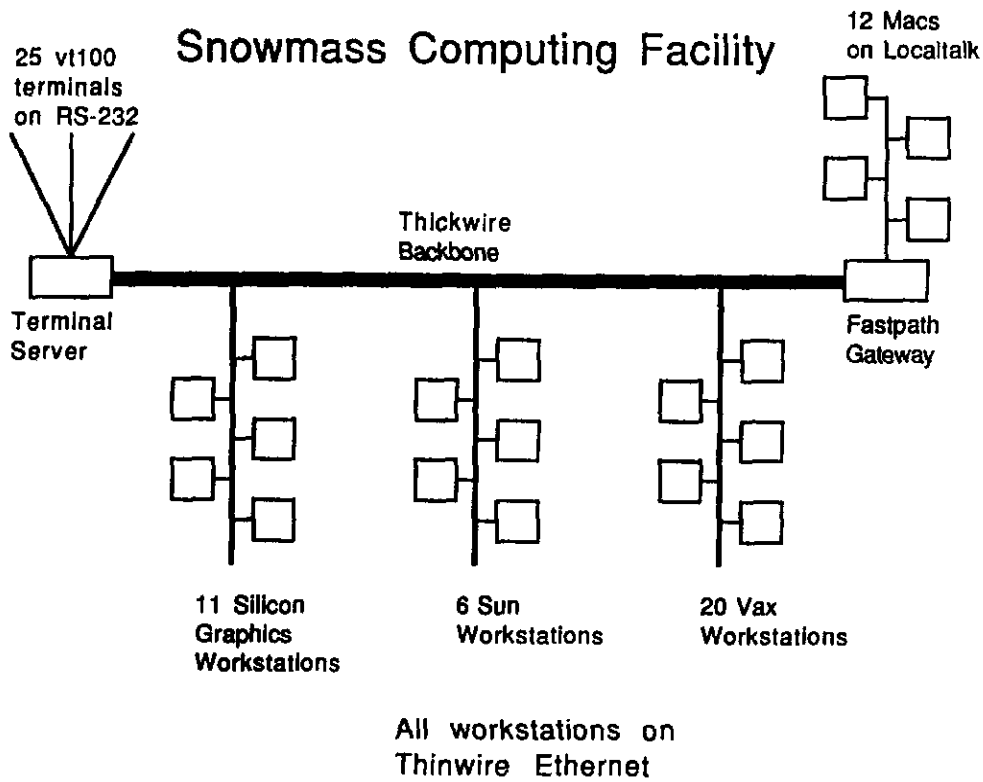
The Fermilab contribution to Breckenridge consisted to a large extent of uncommitted Fermilab experimental equipment -- three MicroVAX 3200's. One was configured as a boot node with an 8mm tape drive. Digital Equipment Corporation agreed to participate in the workshop and to allow their 8 VAXstations to be into the cluster. 26 terminals were brought from Fermilab. There were approximately 40 seats including the Macs. DEC also brought demonstration equipment and personnel which they housed in their own demo room.

At Snowmass, there was approximately 66 VUPs (VAX 780 equivalents of compute power) in VAX/VMS platforms configured with 15 Gbytes of user disk and six 8mm tape drives. Of this, Digital Equipment Corporation provided 4 Microvaxen and 10 VAXstations and Fermilab provided 7 Microvaxen plus a spare as a backup boot node. DEC also provided 25 VT340 terminals.

Silicon Graphics provided 11 Personal Iris' with a total of about 120 Mips. Sun Microsystems brought 2 Sun SLC's and 4 Sun SPARCstations at a total of about 80 Mips.

Ten Macs and a laserwriter were rented locally. They could be connected to the rest of the system via telnet.

The following diagram shows the Snowmass configuration:



The Snowmass computing facility as a whole had approximately 50 seats.

The Field Maintenance Group set up the Fermilab equipment and provided maintenance support at the workshop. 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.

A truck was rented to transport materials and equipment from Fermilab to the workshop. All material to be moved on the truck had to be transported to shipping and receiving by the day before loading. The workshops had to be fairly self-sufficient and therefore adequately supplied with items such as laser printer toner and laser printer paper. On shipping day, the system racks were covered with cardboard sheets and loaded onto the front of the truck for the smoothest ride.

Continuity in technical support was provided between setup at Fermilab and the workshop site. Spares were provided for each of the major subassemblies and then configured into a running hot spare system. The Field Maintenance Group provided maintenance support at the workshop for Fermilab equipment and the laser printers. Since DEC provided Field Service on site, maintenance of the hardware was prompt.

After the workshop 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.

DEC used specially-designed wheeled crates for their equipment which made the moving and packing and unpacking simpler as well as providing much more protection for the equipment than cardboard.

6. Systems

A Fermilab standard VMS system and a selection of DEC layered products were installed on teh system disks at Fermilab. 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, 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 and users were assigned to the multiple user roots according to an expected disk size factor. A utility was used to copy authorization records from the existing FNAL cluster authorization file to the authorization file to be used by the workshop cluster. The utility also created disk directories and disk quota entries. This provided a secure method of establishing user accounts for an off-site event. All attendees with existing FNAL VAX Cluster accounts used their FNAL password (as of the time of the copy) to access the workshop cluster. The utility provides more security than just copying the current FNAL authorization file because it establishes valid accounts for attendees only. During the process, no passwords were compromised since the copy utility copies the binary form of the authorization record. In the case of Breckenridge, generic visitor accounts were pre-created for non-Fermilab users. This was not very satisfactory, and furthermore Snowmass would have many more attendees without Fermilab accounts, so accounts were created for all registrants who filled out the computing questionnaire while the system was still at Fermilab. The new accounts were created with a pre-expired fixed password.

At the workshop, the Fermilab system was first tested to insure that it had traveled well. Then Fermilab and DEC-owned personnel worked together to add the DEC workstations to the LAVC. After that 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 workshop were added.

The UNIX disks, like the VMS disks, were loaded at FNAL, for both Sun and Silicon Graphics, with system and application software, and delivered to the site on the Fermilab truck.

Usernames were created on the UNIX systems for all attendees who filled out the computing questionnaire. The password was fixed and the users were asked to change it on first login. Each UNIX system type was configured with a common password file using Yellow Pages (we were not successful in getting Yellow Pages to work between Sun and Silicon Graphics). Backups of the Sun disks were performed on the 8mm drive connected to the Silicon Graphics system by NFS exporting the disks to the Silicon Graphics master server with the tape drive.

Users were able to print from the UNIX systems on the printers connected to the VMS system.

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. We included instructions in the User's Guide for copying VMS mail files back to a home institution and integrating them into the normal mail file.

7. 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 required, arrangements were made with the vendors. Microsystems Engineering Corporation allowed us to use their MASS-11 product; Talaris Systems Incorporated provided several laser printers and allowed us to use their software during the workshop. Precision Visuals graphics software was covered by existing laboratory workstation licenses. On the FNAL cluster, this type of product is made available with a setup command, and the setups for licensed products were modified to type out credits to the vendors when executed. 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.

On the UNIX systems at Snowmass, the primary application software was the CERN products and some other physics codes. The products disks were NFS exported from the master server to the remaining systems.

Application products were installed on the disks and tested at Fermilab after the system was installed.

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. It turned out to be necessary to modify the documentation at the workshop and duplicate it. Since the workshop systems were close to a clone of the Fermilab FNAL cluster, 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 workshop, at least one consultant staffed the computing rooms during the day, and staff was available intermittently during the evening. An account with username CONSULT was monitored in the consulting office at Fermilab during the day.

A system with such a short lifetime and somewhat indeterminate purpose clearly evolves during the workshop. It is important to have a way to communicate such changes to the users. It is also convenient to be able to communicate other workshop events via computer (although you don't want to enforce logins just so people get the workshop news!). We used a multi-folder bulletin-board product called INFO based on D0NEWS for this purpose. MAIL was very heavily used between support people at the workshop and with the home institution.

8. Conclusions

The computing systems worked well and reliably, and the consensus was that having significant on-site computing capability greatly enhanced the effectiveness of the workshops. It is interesting that the vendors were astonished that people were able to make such intensive use of the computing facilities in such a short amount of time.

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 site selected for the facility should be inspected early and changes or additions made prior to the setup time period. No hardware changes should be made to the hardware after the initial configuration is up and running. Adequate

testing time at the remote site should be allowed for, especially if additional equipment is to be integrated. Phone lines or services should be requested and tested as soon as possible. In the case of Snowmass, the hotel changed their phone system the weekend that we arrived.

It is preferable to keep the number of types of systems and terminals to a minimum for simplicity. There were many problems related to the Macintoshes, much of it due to imported viruses, but also due to the use of unfamiliar software.

It might be necessary, depending on the number of seats, to provide a mail terminal with a slaved printer for 10 minute use only. Lines tended to form 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 workshop.

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 workshop system, and recommend that workshop organizers attempt to make this setup period, as well as the end-of-workshop period, as easy and quick as possible.

The computing facility at Breckenridge provided a standard for workshop organizers to try to meet in the future, but we outdid the standard ourselves at Snowmass with the addition of UNIX capability. The project required close cooperation from all groups within the Computing Department/Division, as well as cooperation with the workshop organizers. 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.

9. Acknowledgements

It should be clear from the above that many many people worked hard to provide the computing facilities at Breckenridge and Snowmass, both at Fermilab and on site at the workshops. We also wish to thank Digital Equipment Corporation, Silicon Graphics, Inc., Sun Microsystems, Talaris Systems, Microsystems Engineering, Precision Visuals, and Boston Business Computing, Ltd. who provided hardware and/or permission to use software at the workshop. Special thanks is in order for the DEC onsite engineer who helped to integrate all the other vendor hardware products.