Network and Hardware Support for the CIS Department

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Abstract

The Technical Division is responsible for developing, designing, fabricating and testing accelerator and detector components. The Computing and Information Systems, a subdivision of the Technical Division, deals with the maintenance of the network, shared files and personal computers, to facilitate the work of the Technical Division. This report briefly describes some of the different tasks accomplished while working for the Computing and Information Systems (CIS) department. Some of the assignments were: assembling new computers, inserting them into the network, installing applications and upgrading computers from Microsoft Windows NT to Microsoft Windows 2000. Other tasks included, creating web pages and documentation, creating mailing lists mechanism, editing printer status utility, restoring compromised computers, reorganizing a patch panel and researching Chili!soft ASP as well as clustering.

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I. Introduction

The Fermi National Accelerator Laboratory, Fermilab, does research mainly on high-energy physics. It has the world's highest-energy particle accelerator, the Tevatron. Fermilab is composed of several divisions. The Technical Division is responsible for building and testing the magnets as well as the machines used in the laboratory. It designed, built and tested about 400 magnets for the new main injector. The Technical Division also participates in international research projects. One of them is the Auger Cosmic-ray experiment in Argentina for which the Technical Division develops the detectors and manages the fabrication and installation (5). The Technical Division is composed of several departments: Support, Machine Shop, Engineering and Fabrication, Material Control, Development and Test and CIS (Computing and Information Systems). The CIS department deals with the computing and networking support of the whole division. It also participates in international projects like the Auger Cosmic-ray for which it is presently designing a database to manage the components used in the construction of the detector. This internship was made possible by the Summer Internship in Science and Technology for Minority Students (SIST) a Fermilab program designated to help minority students. This report provides a brief background on networking, a general description of the Technical Division network architecture as well as a description of the main tasks accomplished while working for the CIS department.

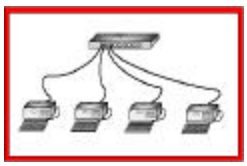
A. NETWORKING

A network is an efficient way of electronically sharing data within a group of people. It consists of connecting several nodes together according to specific architectures and sending data following protocols. Protocols, such as TCP/IP (Transmission Control Protocol/Internet Protocol), are standardized codes that "specify the details of message formats, and describe how to handle error conditions" (1).

Networks can be classified in different ways; one way is by the topology, the second way would be by the dimension and the third way by the type of cable used for

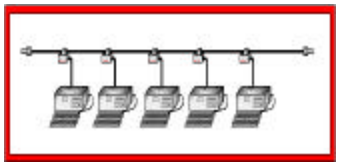
the connection. The main topologies are the star, the bus and the ring. The dimension places the network into one of the following main categories: LAN (Local Area Network), TAN (Tiny Area Network) or WAN (Wide Area Network). The physical connections between the nodes, can be established using principally two types of cable: fiber optic and copper.

The following is an illustration of the three main topologies (6)*:*



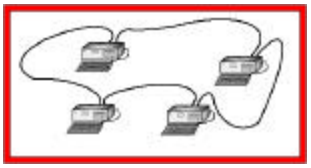
Star topology

Fig.1



Bus topology

Fig.2



Ring topology

Fig.3

In a star topology, each machine is connected to the central switch or hub. In a bus topology, each PC is connected to a backbone cable ended on both sides with terminators. In a ring topology, the PCs are connected to each other forming a circle.

The following graph is a general description of the Technical Division networking system:

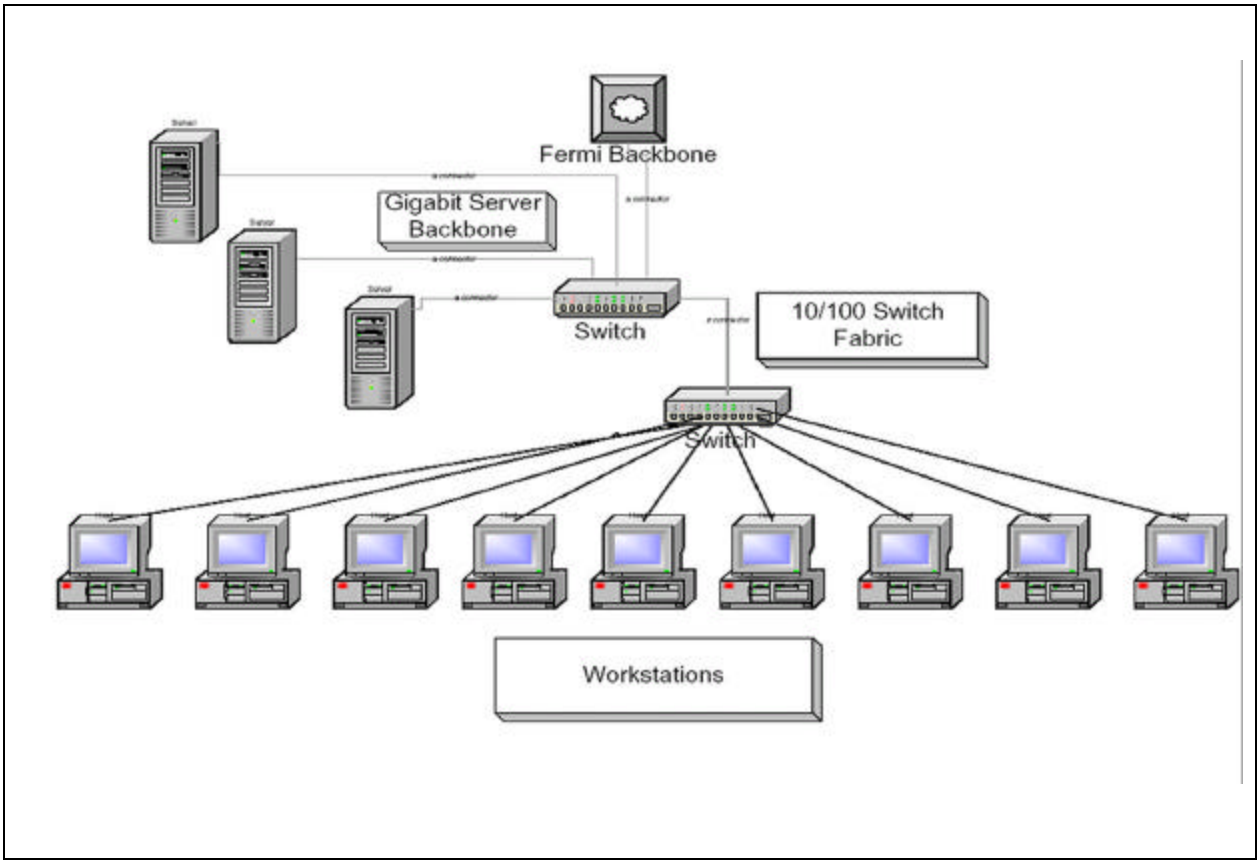


Fig.4 Technical Division network

The cloud represents the Fermilab backbone, which is connected to the Internet using a gateway/router. A switch is directly connected to the backbone and to several servers by a 1-gigabite cable (fiber optic). It is connected to a second switch by a 1-gigabite cable (copper). The second switch has a 10/100-speed Internet connection (copper) and is connected to the PCs and UNIX machines. The Technical Division area campus has a fiber backbone to connect out buildings via gigabit Ethernet.

Security threats are an unfortunate consequence of electronically sharing information. Therefore, beside the typical log on banner asking for the user name, password and domain, Fermilab adopted a new authenticating system called Kerberos.

B. ASSIGNMENTS

Being assigned to the CIS department presented an occasion to work on several projects such as upgrading machines, restoring compromised computers, backing up the PCs, helping install Solaris™ 9 on a new Sun server. The following are some of the main tasks accomplished. The main assignments were assembling computers and inserting them into the network, upgrading printer status lists, creating web pages documentation and creating a mailing lists mechanism.

1. Assembling computers and network configuration

a. Assembling a computer

To assemble a basic computer with a Pentium IV processor and a RAMBUS-based motherboard, there are about four steps. The first step is fixing the power supply and the motherboard to the box. The power supply will be connected later on to each device. The second step is installing the CPU (Central Processor Unit) and its fan. The following step is fixing the memory RAM (Random Access Memory) and the drives to the motherboard. The memories, the video card and the NIC (Network Interface Card), if necessary, are slid into their respective slots. The hard drive is set to master and along with the floppy drive, fixed to the box. The next step is connecting the hard drives and CD-ROMs to the motherboard using IDE cables. The floppy drive is connected to the motherboard with a floppy drive cable. At last, the front panel connector is connected to the motherboard.

b. Installing applications

After assembling a personal computer (PC), two partitions are created and the hard drive is formatted. Windows 2000 is installed on the computer using the Microsoft Windows 2000 CD-ROM. The computer is then physically connected to the network by a cable. Then the standard applications such as Microsoft Office 2000, PaintShop Pro 7.04 or the Kerberos aware applications, WRQ/Reflection, are installed on the machine. Those applications are stored in the *PCapps* shared folder on one of the servers called

tdserver1. The computer can be just upgraded from Microsoft Windows NT to Microsoft Windows 2000. If the computer is compromised, the hard drive must be formatted and the partitions created before installing the applications.

c. Network configuration

Once the applications are installed, the new PC needs to be inserted into the network by filling out a registration node form sent to the Computing Division, specifying the network configuration providing a hostname, a hardware address and an IP (Internet Protocol) address to the new machine. The IP address should be unique within the network. An example of IP address would be 131.225.45.2. It consists of four numbers between 0 and 225. The first two numbers are always 131 and 225 for the Technical Division. The third and fourth numbers specify the network and the machine. They are either 44, 45 or 46, for the PCs, 47 for a subnet isolated by a router. 153 is used for printers and other utility devices.

To find a new IP address, one can use the *nslookup* command from the DOS command line interface. To find an IP address from a hostname, the following format is employed: *nslookup <hostname>*; in the opposite case, the format used is: *nslookup <IP address>*. The *nslookup* command works the following way: a given random IP address is converted into DNS address and sent to the DNS server. If there is a match with one of the addresses in the server table, a packet is sent back with the hostname and the server name on which the PC is on, then the server name and hostname as well as the IP address are printed out. If there is no match, it means that the address is not in use yet and, therefore, could be assigned to a new machine. However, in case of a simple upgrade, the computer already has an IP address.

2. Updating printer status list and creating web pages documentation

a. Editing Printer Status list.

The Fermilab Technical Division - CIS TD Printer Status Information list, which can be found at www-td.fnal.gov/CIS/print-plot/print_status.html was created to furnish status of printers from the Technical Division. However, it needed to be edited to

provide more accurate information about the printers for a better management of the division hardware. The names of the printers that must appear on the list are displayed on *Tdprint*. *Tdprint* is a server in the *Tscis* domain, to which all the printers are connected. The status and other information about the printers are published on http://tdprint:8000/, using a package called *WebjetAdmin*. *WebjetAdmin* is a live web database that provides information such as the printer status, hardware and IP address, hostname or IPX name. It also gives a brief description of the printer, its name, as well as its location.

To assess the printers that should be added to the edited list, the names on *Tdprint* are compared to the names or hostnames listed on *WebjetAdmin*. If there is a match, the printer name is added to the list edited with a link leading to the *WebjetAdmin* status window of that particular printer. The link is created from the hardware address appended to the current *WebjetAdmin* page URL address or from the hostname in the case of a Xerox Tektronix printer. Usually hostnames belonging to Tektronix printers have "tek", for example: td-tek560-2.fnal.gov. The status is communicated directly from the printer.

However, if some names cannot be matched, their IP addresses are found on the *Tscis* server by switching onto the server itself using Timbuktu 5.0 (7). The IP addresses are then matched to the list provided by *WebjetAdmin*, then the link is created from the hostname or the hardware address. This is an example of link created from the hostname: *http:// td-tek560-2.fnal.gov* and this is an example of a link created with the hardware address: *http:/tdprint:8000/cgi/wja?page=support/device.hts&dev=0010835664B7,0;* 0010835664B7 being the printer hardware address.

The following is a diagram illustrating the relationship between each web pages:

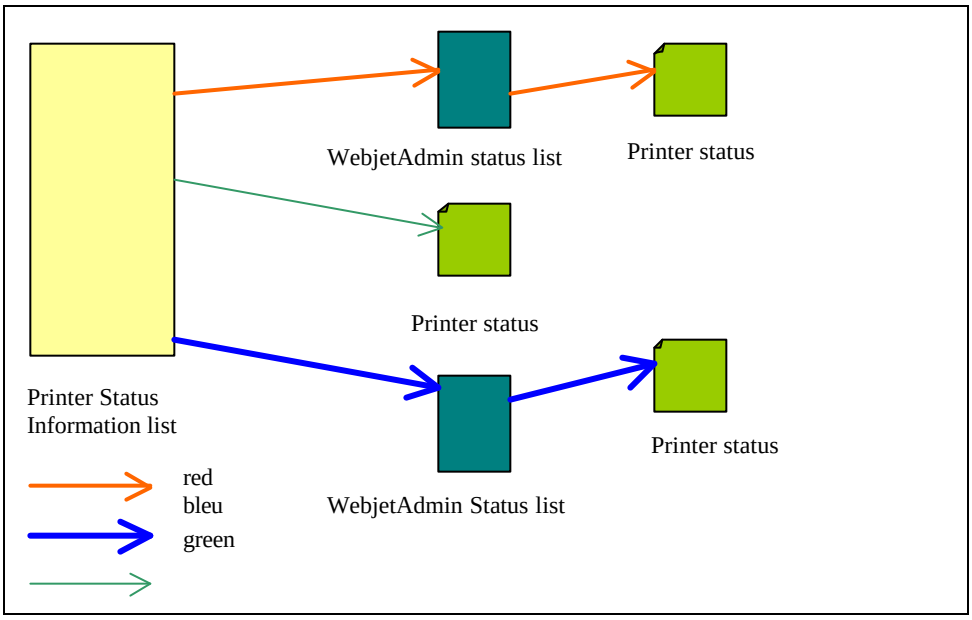


Fig.5

The red arrows represent the link created with the hardware address from *WebjetAdmin* Status List page. The green arrow represents the link created with the hostname. The blue arrows represent the link created using the hardware address from *WebjetAdmin* View List page. Note that a link can also be created with the IP address, for example: *htpp://131.225.157.206*. Those links are created so that when the user clicks on the printer name on the CIS TD Printer Status Information web page, the status page of that specific printer opens up.

b. Creating web pages documentation

The next task was creating web pages and documentation explaining how to assemble a computer and how to format UNIX machines hard drives. This documentation would be available to any person who would want to build a computer or format a hard drive of a UNIX machine. The web pages were created using Mozilla 1.0 (4) web editor. Pictures as well as links to more detailed explanations were added for better understanding.

This is a schematic explaining the relationship between the pages.

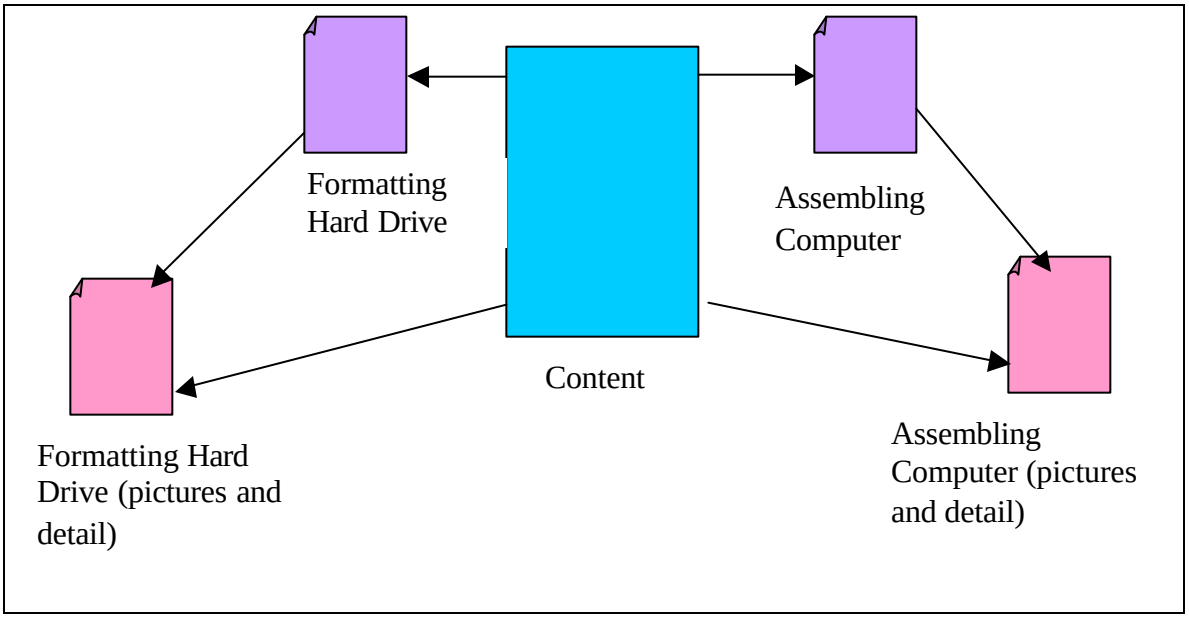


Fig.6

The "Content" page displays only the title of the four other pages. Each title is a link leading to the page with the corresponding title. "Formatting Hard Drive" and "Assembling Computer" are the main two pages that explain the procedure. For better understanding, these two pages provide links to two other pages with more illustration and detail.

3. Creating mailing lists mechanism

A mailing list mechanism needed to be implemented to facilitate emails usage. The mailing list of the whole Technical Division is designed the following way; the email addresses correspond to the departments of the Technical Division. On a PC, the mailing lists are created using TextePad 4 and saved as UNIX files. An aliases file is created mapping aliases to the mailing lists using a UNIX machine. The mail server, *tdsu47*, has Solaris™ 8 OS and uses a software package called SendMail (2) for email management. The email address used to send an email follows the following format: *file name @ Tdmail.fnal.gov*, *Tdmail* being *tdsu47*, the mail server. The software Samba 2.2.4 (3)

allows a Microsoft Windows OS Personal Computer to communicate with the server tdsu47 using a UNIX OS.

On *Tdmail*, "mailer", a group of usernames, is given permission to write, in other word, to edit the mailing lists. The NT accounts of the Technical Division are on *tdserver3* and the UNIX accounts are stored on NIS™ (Network Information Service) which happens to be on *tdsu47*. When a user logs onto the NT computer and open a mailing list, the user's password is encrypted and sent to *Tdmail* which verifies the authenticity of the password then checks if the user has write permission before modifying the list if changes are requested.

II. Conclusion

Working for the CIS department was an opportunity to acquire a deeper understanding on networking and computing systems. The three main tasks assigned during this summer were: assembling computers and inserting them into the network, upgrading printer status lists and creating web pages documentation and finally, creating a mailing lists mechanism. However, several other tasks were also assigned. Some of them were: upgrading machines, restoring compromised computers, backing up the PCs, helping install Solaris™ 9 on a new Sun server, punching wires as well as researching Chili!soft ASP™ and clustering for future networking projects. Each task contributed to ease the work of the Computing and Information Systems department by providing PCs when needed; by helping restore compromised computers; and by providing and updating web documentation. The major challenge during the internship was learning to design web pages and familiarizing with the HTML code.

Being an intern at the Fermi National Accelerator Laboratory was a great experience. The work environment was very satisfying. The SIST committee as well as the employees from my department were very welcoming and helping. The SIST program also organized weekly lectures on topics such as quantum physics, particle physics and extra dimensions. During one of these lectures, I had the honor to meet Dr Leon Lederman, 1988 Nobel Prize Winner. In fact, being exposed to those lectures

opened my horizon and increased my interested in sciences, more precisely, physics. For all those reasons, I would consider working again for Fermilab.

III. Acknowledgements

I would like to thank the SIST committee for providing me with the opportunity to work at the Fermi National Accelerator Laboratory and for publishing my paper in the Summer Internships in Science and Technology Program 2002 Summer Report as well as on the web at www.fnal.gov. I also thank my supervisor John Konc for his teaching and guidance as well as Chandra Bhat my mentor for his assistance during these three months.

IV. References:

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