Windows NT at DØ

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DØ is actively pursuing the use of PCs running Windows NT as a principal new desktop machine. This paper will discuss DØ's usage of NT and our experiences to date.

Key words: Commodity Software; Windows NT; Desktop Computing

1 Introduction

The computing plan for the DØ Experiment at Fermilab in the Run II era includes a flexible hierarchy of machines. We expect that bulk data access and processing will take place on large central UNIX platforms with access to Terabytes of disk and many Terabytes of robotic storage. The next level in the hierarchy will be several workgroup servers, UNIX or possibly NT, with access to reduced data sets by groups of users. Another level will be occupied by UNIX workstations, active in code development and dedicated small data set processing. The final level is the desktop, which we expect to be populated principally with PCs and X-terminals. DØ has chosen to use Microsoft Windows NT [1] as the principal operating system for the PC platforms. In this paper we will discuss our goals, current implementation, and general experiences with NT.

This document does *not* reflect a technical evaluation of either the NT operating system or of any of the other hardware or software products mentioned. Rather, it is a description of our chosen implementation, with comments on our experiences. This paper is also *not* a report on any official Fermilab or Fermilab Computing Division recommendation on operating systems, hardware,

[1] http://www.microsoft.com

or PC software. It is instead a report on PC use by a (sizable) collection of members of the Particle Physics Division / DØ Project and various university collaborators resident at Fermilab. The Computing Division does support NT for a number of business and technical groups at Fermilab, but its relationship with DØ at this time is mainly advisory.

2 Requirements and Goals

Approximately two years ago we began our evaluation of alternatives for desktop computing. Our goals were to provide:

- replacement of a large number of machines with a limited budget;
- inexpensive access to all other levels of computing;
- easy access to common desktop office applications;
- a code development environment for any or all of the operating systems supported by the experiment; and
- optimal performance for all varieties of applications.

The X-window system makes possible access to multiple machines and platforms, so X-terminals would seem to provide the lowest cost desktop solution. With the existence of multi-user PC systems (as will be described below) then even PC applications are accessible. However, when the issue of performance is also considered then X-terminals are deemed to be inferior for many tasks.

Windows NT has been preliminarily selected as the operating system for the Level 3 software trigger processors within the DØ Run II data acquisition system. There is thus some motivation for providing an NT development environment to a large number of potential code developers. The goal of future DØ software development is to produce platform independent code; it is desirable to use the most effective code development environment — which may well be on a PC.

The DØ plan is to acquire a mixture of computing platforms, where each is chosen to satisfy to a particular user's principal needs, yet flexible enough to respond to secondary needs. A UNIX workstation is most appropriate for a user doing code development principally for a UNIX environment, or a user requiring workstation processor or graphics performance. Lower cost PCs provide intermediate yet adequate performance, a PC code development environment, plus native access to many commercial desktop applications. The X-terminal provides the lowest cost solution for the least demanding users. All solutions provide at least some access to the resources and capabilities of all of the computing resources within DØ.

D0 has chosen to pursue Windows NT as the operating system for the PCs within this scheme. Additionally, X-terminal access to PC applications is provided by a server running the WinCenter [2] product.

3 Implementation

3.1 Hardware and Operating Systems

DØ employs three server systems: (1) the Primary Domain controller, a Micron [3] 200 MHz Pentium Pro with 128 MB memory, 20 GB SCSI disk, and FDDI, running Windows NT Server Version 4.0; (2) the Backup Domain controller, a Digital [4] DEC AXP150 with 64 MB memory, 8 GB SCSI disk, and FDDI running Windows NT Server Version 3.51; and (3) the WinCenter Server, a Micron 200 MHz Pentium Pro with 128 MB memory, 2 GB SCSI disk, and FDDI, running NCD WinCenter Version 2.0.21. The Micron servers cost approximately US$7000 each (including software), the DEC server cost about US$5000 when new. The WinCenter 15-user license was purchased for approximately US$400 per seat.

There are currently more than 30 local PCs, owned by Fermilab or collaborating universities, which run NT Workstation. The typical NT Workstation node has the following configuration: a 100 MHz Pentium with 32 MB memory, 1 GB IDE disk, a 21" color monitor, 10 Mbit Ethernet, and Windows NT Workstation Version 4.0 or Version 3.51. The approximate cost of such systems was US$4000, although superior systems could be obtained now at similar cost. Approximately five users have PCs at home which also run NT Workstation. These users have ISDN or dial-up PPP access to Fermilab.

The file and print services of the NT Servers are also used by approximately 50 Macintoshes [5] and other PCs at DØ. The PCs use any of the Microsoft Windows 95, Windows for Workgroups, or Windows 3.1 operating systems.

Several other devices are used in conjunction with the DØ NT system: a Pinnacle Micro RCD5040 [6] CD Writer used to archive data sets, a Quantum DLT 2000 [7] tape drive used for system backups, and various network capable Black & White or Color Postscript printers.

[2] http://www.ncd.com
[3] http://www.micronpc.com
[4] http://www.digital.com
[5] http://www.apple.com
[6] http://www.pinnaclemicro.com
[7] http://www.quantum.com

3.2 Administration

All users of the DØ NT system are members of the DZERO NT domain. System security is established with respect to this domain name. At Fermilab there is now also a single FNAL domain being created. The eventual plan is to give every Fermilab user a FNAL domain account and enter them into user groups representative of their affiliation, e. g. as a member of DØ. In this secenario there will be no DZERO domain user accounts; instead the FNAL domain will be trusted within DZERO and users may use their FNAL accounts. Security will then be established using the FNAL groups in addition to the individual user names.

As noted above, there are approximately 50 non-NT (Macintoshes or Windows PCs) machines using the DZERO domain resources. Most of these users are given DZERO accounts and then, by supplying their passwords, have access to the domain resources. Other users may access the system with restricted guest privileges.

The DØ philosophy with the NT systems is to center as much crucial activity on the server nodes as possible. Thus the two servers mount NTFS disks containing user storage areas and application distribution folders. The user disk, 9 GB for nearly 300 users, is expected to contain only documents. The application disk contains either the distribution set or the network accessible executable for each of the supported applications.

The servers also mount NTFS disks for common use of the Macintoshes and Windows PCs. These disks, 13 GB in total, are expected to be similarly used to contain user documents and the standard application distribution packages.

The user data disks on the servers are regularly backed up to DLT tapes. The application disks can be restored, if necessary, from the original distribution media.

The standard configuration of an NT Workstation is with a single NTFS local disk. For efficiency purposes, applications are installed from the server to this local disk. The remainder of the disk is considered to be scratch space for the local user. Users are strongly encouraged to store nothing of vital importance on the local disks; these disks are not routinely backed up.

Remote access to the WinCenter server also requires a DZERO domain account. The remote user invokes the product using rshell, then uses X to send the display back to his desktop platform. This server is otherwise configured as a typical workstation.

3.3 Software

Listed below are the principal installed software products:

– *Microsoft Office*, Version 7.0, with active use of Excel, PowerPoint, and Word;
– *Microsoft Project*, Version 4.1, for project scheduling and resource management;
– *Microsoft Internet Assistant*, for generation of Web pages from the Office products;
– *Exceed* [8], an X server with a set of internet tools;
– *Microsoft Visual C++* and *Borland C++* [9], C++ compilers and development environments;
– *Scientific WorkPlace* [10], a TEX document development package;
– *Microsoft Internet Explorer*, *Netscape Navigator* [11], and *NCSA Mosaic* [12] Web browsing packages plus assorted viewers; we are also evaluating a number of Web editing tools;
– *various e-mail and news tools*, including Eudora [13] and tools associated with the common Web browsers; and
– *Backup Exec* [14], a disk backup utility.

DØ is also evaluating the use of the gnu [15] tools in the NT environment. We anticipate these tools to become increasingly important as more code development is done on NT.

4 Experience

DØ now has roughly two years of experience with NT in wide and general use. A set of observations follows:

– *System Management*
The DØ NT system is managed by a single dedicated Computing Professional with extensive PC skills. The Fermilab Computing Division PC Support Group provides a small amount of technical assistance, but currently

[8] http://www.hummingbird.com
[9] http://www.borland.com
[10] http://www.tcisoft.com
[11] http://www.netscape.com
[12] http://www.ncsa.uiuc.edu
[13] http://www.qualcomm.com
[14] http://www.smg.seagatesoftware.com
[15] http://www.fsf.org

does not control or otherwise get involved in DØ's operations.

- *Management of an NT system*
  DØ NT users come from two distinct desktop backgrounds: former VMS users and former Windows PC users. There is a marked difference between the operational demands of the two groups; the former VMS Cluster users are *much* easier to please. Having come from a centrally managed environment, the VMS users are already accustomed to viewing their local machines as all similarly and standardly configured, with (often remote) controlled disk storage and peripheral access. However, PC users expect to be able to customize their systems as desired, usually on their own and following no standard presciptions. They are also more inclined to store all documents locally, which bypasses the current backup scheme. In summary, the migration of VMS workstation users to the NT system is without management difficulties, but the former PC users tend to demand customization and prefer to operate outside of the desired standard methods.
- *Central File Server*
  The scheme to place all common applications and all user documents on the central NT servers has been well received. Software product updates (particularly for the public domain or site-licensed products) are straightforward; the local NT administrator or the individual PC user may update the local system as needed. The common location of the user data files allows easy shared access without the need to mount numerous individual workstation disks. The common user disk is also easily backed up.
- *The WinCenter Server*
  Since the DØ computing plan includes many X-terminals and numerous UNIX workstations as desktops, it is essential to provide remote access to PC applications. DØ selected the WinCenter product for this purpose, and provides a powerful PC as the host. In general our experience with WinCenter has been favorable. We have load tested the machine with a full complement (15) of licensed users without unexpected failure, but the average daytime load is 5 users. The most popular applications are those from the MS Office suite — PowerPoint and Excel — with increasing use of MS Project. However the WinCenter system does suffer some problems, most notably when a single process places a high demand on resources (notably memory). In such a case the entire server may grind to a halt. All NT applications also do not necessarily run on WinCenter; a special patch was needed to run the Office95 products.
- *NT Security*
  One of the reasons for choosing NT was that it provided many security features. In particular, VMS users are very familiar with the ACL structure. Users are also more amenable to central file server storage when their files can be protected as necessary. We also provide several public-access PCs at DØ for general collaboration use; these machines have the basic system folders protected to avoid accidental corruption.

– *Licensing*
Software licensing for the DØ NT system has been quite painful. At the moment we have found no good standard solution. Our license enforcement methods have been a mix of:
  · Fermilab site license purchases;
  · Fermilab bulk license purchases, with concurrent use controlled by a key-server (currently a Macintosh) application;
  · Fermilab bulk license purchases, with individual use assigned to a user or to a specific machine;
  · licenses supplied by the OEM with the hardware purchase, but often upgraded by a separate purchase for each machine;
  · licenses limited in numbers purchased, with access controlled by NT file security;
  · shareware licenses;
  · demo licenses for products under evaluation; and
  · licensed products accessed in *good faith*.

  Licensing issues are further complicated by the presence of the multi-user WinCenter system, where it is often not clear whether the machine needs a license, each user needs a license, or the machine and/or user withdraws a license from a keyed pool. In summary, our view is that the PC licensing situation is extremely hard to decipher, if not inherently chaotic.

5 Future Plans

DØ's experience with NT on a PC as a desktop platform has been positive. We expect to continue to expand both Fermilab and university components of the system. Specific action items in the future include:

– greater attention to software license management;
– implementation of roaming user profiles;
– investigation of hardware reliability issues, including RAID disk arrays and multiple servers;
– increasing use of PC tools for code development; and
– potential use of PCs in the physics analysis environment.

We fully expect NT to play an important role in the future of DØ.