THE EOS/UNITY ACADEMIC COMPUTING ENVIRONMENT

North Carolina State University (NCSU) offers its students and faculty one of the best and largest distributed academic computing networks in the world. More than a decade of planning, development, expansion, and use has gone into delivering this massive and versatile product to campus. 1994 was the first year that all students and faculty received an account on Eos/Unity, which is now well established as a campus-wide system.

The system has notable underpinnings. In 1989, the NCSU College of Engineering (COE) Computer Committee, led by William E. Willis and Thomas K. Miller, traveled to MIT to investigate and assess the innovative Athena Project. Begun in 1983, this project was a decade-long effort by MIT, IBM, and Digital Equipment Corporation to develop a large-scale academic network with specifically designed software for educational and research computing.

Impressed by the power, security, scalability, and all-round functionality of the system for a large user community, the committee set about importing the Athena technology to NCSU. Since its first year of operation in 1990, students, staff, and faculty have been adapting and extending the system, taking it well beyond its Athena origins to what it is today: a large-scale, multi-platform network for 40,000+ users.

Legacy System and Unix/AFS Infrastructure

Named Eos after the Greek goddess of the dawn by students in the former Computers and Technologies Theme (CATT) dorm, the student computing environment in the College of Engineering gradually grew into the campus-wide Unity system. Textiles joined Eos in 1992, followed by PAMS and CALS in 1993. In 1994, NCSU Computing Services took on the role of setting up and administering the infrastructure for the entire campus, calling it Unity. All NCSU students and faculty received accounts on Eos/Unity, engineering users in the eos.ncsu.edu cell and the rest of campus in unity.ncsu.edu.

Eos/Unity implies that there are two systems on campus rather than one. In fact, there has been only one system campus-wide since 1995, when all accounts moved to Unity (some legacy staff/faculty accounts remain in Eos). However, COE still uses Eos to name engineering computing and partners with campus to develop technologies everyone can use.

NCSU home page on the World Wide Web:
http://www.ncsu.edu/

Project Athena: a decade-long research and development project at MIT to support engineering education and research in a distributed computing environment.

Project Eos/Unity: a Unix, Linux and Windows distributed client-server network. NCSU’s Eos/Unity environment developed from MIT’s Athena Project.

NCSU College of Engineering home page for Eos:
http://www.eos.ncsu.edu/

NCSU home page for Unity:
http://www.ncsu.edu/it/essentials/

cell: an independently administered site running AFS and consisting of a collection of file servers and client machines defined as belonging to the cell.
The software that is primarily responsible for creating the common environment and uniting all the cells (eos.ncsu.edu, unity.ncsu.edu, and bp.ncsu.edu, or “backbone protocol”) is the Andrew File System (AFS), an implementation of Carnegie Mellon University’s Project Andrew (first owned by Transarc Corporation and now by IBM and OpenAFS). This software creates the shared file space that users move around in. The authentication system used to check that users are who they say they are is Kerberos, developed in MIT’s Project Athena.

Unix, specifically Sun Solaris, is the principal supported operating system. Eos/Unity has always run Unix in a client-server distributed architecture. Running on top of Solaris is the X Windows System, developed in the Athena Project, which uses the X client-server protocol.

Users can log in to the system from any Eos/Unity workstation and be admitted to a secure but common graphical and multitasking environment. Users can customize this environment as they like, and it is downloaded whenever they log in to any machine on the network, making popular the line from the movie, Buckaroo Banzai, “No matter where you go, there you are.”

The 75+ commercial applications on Eos/Unity include more than 30 for Sun Solaris (see Appendix C). Software is regularly upgraded to keep it current. Because students will use these programs again in the jobs and professions they enter after college, an introduction to this software at NCSU is a valuable addition to their education. Moreover, most of these packages are too big and expensive to acquire by any other means than a shared networked system. For an individual to buy, store, and maintain such a suite of software would be practically impossible.

In order to make such a suite of software available to all students, NCSU has installed workstation laboratories all across campus. Like software, the computing hardware is regularly upgraded. Each summer, hundreds of workstations are replaced in the public labs. Realm hardware and software are paid for out of the student Education and Technology (ETF) fee, with supplemental support from departments and colleges.

**The Windows 2000 Platform**

While Unix and its application software have supplied campus users with much of the functionality they have needed, this software has not been all things to all people. Unix and AFS have given the campus a secure and scalable infrastructure, but they have not been able to provide the many popular Windows-only applications that users have wanted. As a result, campus Information Technology Division (ITD) developed a non-Unix client for Eos/Unity built on Microsoft Windows.

In March 1998, ITD put 71 Windows NT workstations in the newly refurbished Language and Computer Labs, AKA “the Laundry.” ITD led
the effort to develop the NT platform into a reliable and full-functioning client for campus, subsequently developing the GINA (Graphical Identification and Authentication) for a single Kerberized login and integrating it with NT AFS, Netware Directory Services (NDS), and the Novell Application Launcher (NAL) in fall 1999. The platform ran AFS as the file system and used the user’s home directory for data storage rather than the PC’s hard drive.

In 2000, ITD integrated Windows NT into the existing Eos/Unity and Novell Directory Services (NDS) infrastructures and stopped using the GINA. With the implementation of Windows 2000, users log in through NDS and KAUTH (Kerberos and Transarc AFS) to get access to their Eos/Unity AFS space.

This year, the College of Engineering released Wolfcall, a downloadable Kerberos for Windows + OpenAFS, used in the Eos labs and by users at home and in offices to connect to AFS. Users are encouraged to store their files in their AFS space rather than on the local hard drive because AFS space is backed up nightly. In labs, it is not possible to store on C:, the hard drive, so users must save to their K: and J: drives.

Each user has a roaming profile of individual preferences and application settings that is stored in the user’s NetWare profile space on the M: drive. Applications are delivered to the workstation using Novell’s ZENWorks and the Novel Application Launcher.

In simplest terms, MS Windows creates a familiar user front end with abundant applications, and Unix and AFS provide the back-end infrastructure harnessed to a large-scale campus network. User files, software, and customizations download to Windows clients similarly to the way they download to Unix workstations. An impressive suite of application software is available for this platform, see Appendix C and http://www.eos.ncsu.edu/software/.

**Eos Linux: NCSU Realm Kit for Red Hat Linux**

In 1999, Linux was added to the mix with an “Eos-ized” Red Hat Linux 5.2, thanks to support from Red Hat Software, Inc., and the Office of Information Technology and Engineering Computer Services (ITECS) in the College of Engineering. Developed by Textile Engineering Professor, Warren Jasper, and student, Matthew Wilson, an Eos Linux CD and installation manual were distributed in summer 1999.

Development continued in ITECS with the fall 2000 launch of Realm Kit for Red Hat Linux, based on Red Hat 6.2. This distribution had several campus add-ons in one install package (no CD, network install only). The Realm Kit was used principally in the College of Engineering and installed on all Dell lab computers in Leazar and Withers (more than 175 machines in all). These labs are the main labs for E115, CSC114, CSC112, and CSC116 classes.
The Realm Kit has moved through versions 7.1, 7.2, and 7.3. In 2002, development was picked up by the College of PAMS, which this year, released the Realm Kit for Red Hat 9.0 with enhanced security and bug fixes. Users have access to their AFS file space, just as they do on the other platforms, and to such popular utilities as Zephyr (an Athena application for instant messaging). More information on the NCSU Linux Users Group (LUG) and the Realm Kit for Red Hat Linux is at http://www.linux.ncsu.edu/

Student-Owned Computers

NCSU has had a long-term commitment to providing facilities that meet all of the computing needs of its students. Because of its extensive campus resources, NCSU does not require students to own computers. However, surveys of incoming freshmen show that nearly all of them do (97%), and these student-owned computers provide additional benefits.

Students with their own computers are able to run software that is bundled with textbooks or which their instructors may distribute or require. They have 24/7 access to mail, Web, and network-based resources that their classes rely on. In addition, they have the advantage of being able to work at home rather than in the labs and install software of their choosing, which is not permitted on university-owned computers. If their computers are laptops, they can use them in classes and the library and take them home with them over holidays.

For these reasons, the College of Engineering has recommended that its students own or have access to a personal computer. Other colleges have their own guidelines, as does NCSU (see URLs in margin). Students who purchase computers can consult Do I need a computer at NC State? for recommended specifications. Also, ResNet helps students in the residence halls take advantage of the computers they bring by offering network access and support.

The College of Engineering is developing its student-owned platform to better interface with the Eos/Unity network and environment so it can be used effectively in the classroom. COE established a pilot laptop program with freshman engineering students to work toward these goals. The program enters its third year in Fall 2003.

In conjunction with this program, COE has worked closely with IBM and Dell to obtain special pricing on laptop computers for all NCSU students, faculty and staff, as well as for NCSU institutional purchases. Specifications and pricing for Dell and IBM laptop computers are available at http://www.eos.ncsu.edu/soc/.

North Carolina State University welcomes you to the powerful and versatile Eos/Unity computing environment. Any suggestions for the improvement of this manual may be sent to mcdaniel@ncsu.edu.