ASU Fletcher Library
Technology Support & Development
E3 Technology Roadmap
Executive Whitepaper Case Summary

Background History

Fletcher Library on ASU's West campus is visited by an average of 1,000 people each day who come to access the physical and virtual collections that support their research and studies. Maintaining a library has always been an expensive venture, but costs have escalated dramatically as libraries have moved from physical card catalog systems to "dumb terminals" in the 1990s to today's sophisticated computer workstations that connect users to the World Wide Web and a myriad of electronic collections. In 2005, we not only provide books, media, journals, and study space, but we must also purchase electronic subscriptions and the computing hardware and software that support all levels of research and learning. Historically, Fletcher Library has replaced its public computing hardware every three years. These three-year cycles have provided an opportunity to assess future needs for the next cycle replacement and, in 1999, as we faced budget revertments and rising costs, the need for change became evident.

Since 1996, the Library has used Microsoft operating system and software applications. Our software licensing costs and new hardware costs were increasing. Our long-term technology support funding has never been stable since, like many departments within the University, we have relied on salary savings to fund technology-related purchases. As we filled vacant positions to meet the growing numbers and needs of Library users, flexible spending from salary savings was diminished to a level that made technology funding requirements unsustainable. An additional complication came in the form of budget revertments in FY 01/02.

Furthermore, Library services were limited by the Microsoft Windows operating system and applications. Microsoft is designed for home and business use, and source code cannot be altered in ways that support modifications useful to reference and instruction services. Instructions that would be most helpful for a user cannot be integrated. The Library Technology Support and Development Department (TS&D) was therefore not able to respond to staff requests to change menus, headers, dialogs, etc. of the Windows desktop and applications. These limitations and restrictions prevented us from providing students and other users with personalized or customized applications and interfaces that could enhance their learning experience.

System problems increased over time and required greater financial and staff resources. Troubleshooting consumed 18% of technology staff time as we dealt with problems which included unknown application and operating system crashes, system memory failures, hard drive corruption, and server patches, fixes, and anti-intrusion measures. Our users experienced inaccessibility of the floppy drive, default of our home page to porn sites, and disabled workstations - all resulting in disruption of their research.

Two things became apparent: Using the existing Microsoft architecture, the Library would not always have the resources to sustain its technology infrastructure and could not take full advantage of information resources and instructional opportunities. It was equally obvious that solutions would not be forthcoming from Microsoft. As we conducted research for alternatives, we identified a movement within the Fortune 500 companies that were making serious financial investments in open source-based technology solutions using Linux. Our research of university libraries revealed instances of only partial application of Linux in single servers, specialized workstations, or small labs. No models in production existed to show us the way.

To be objective, we investigated other Unix-like systems including BeOS, BSD, Mac OS X, and Sun Solaris operating system. After detailed review, Linux was identified as a viable and affordable alternative operating system.

Solution Identified

By 1999, TS&D staff had thoroughly researched the application of Linux technology through review of research and Internet articles and discussions with information technology peers in various countries including Australia, Brazil, Germany, Mexico, New Zealand, and the United Kingdom. After considerable exploration, TS&D proposed a drastic change in the Library's core computing architecture: to migrate our public and classroom workstations and servers from Microsoft Windows to Linux. This proposal did not simply suggest an operating system change; it introduced a hybrid concept of merging the best of thin-client technology (the simplicity of dumb terminals) with fat-client technology (reliance on a local hard drive for the operating system and application storage) at an affordable cost. This could be accomplished by creating workstations that received a clean hard drive image, free of corruption, every time the machine starts. Further, we could adapt the system into using its RAM memory as the hard drive, eliminating the need to have physical hard drives on the workstations thereby reducing workstation cost, increasing disk access speed, and eliminating a major source of heat and system failure.

Based on extensive research conducted in our pre-planning phase, the hybrid concept we developed is unique and had not been documented and/or operationalized by any other institution. Because the Linux operating system is open source, (code is readily available, customizable with little or no restriction, and free of charge), we could respond to requests from Library personnel for customizations that would enhance our services. Using a Linux platform would enable the Library to tap into the open source collective of experts, programs, and other resources which would complement the Library's existing expertise, address user needs with fewer barriers towards solutions, and allow for creative endeavors that were not available while using Microsoft Windows. Open source would allow us to modify an application or operating system source code (program) to behave and display exactly what we wanted. In addition to the Linux operating system, there are 90,000 open source applications for our use at any time.

The risks for the Library were high because evidence of application of Linux was scarce, and there were no models from which we could draw. If successful, however, we knew we would eliminate our high-cost reliance on Microsoft architecture, hardware, and software that was consuming ever-increasing portions of our shrinking budget. We would create a platform on which the Library could implement innovative services, sustain infrastructure, and take full advantage of emerging technology.

When our research began in 1999, few institutions had attempted a system-wide migration to Linux. We envisioned paving the way for other organizations to apply the benefits of open source technology as well as contribute the results of our innovation to the library community. The project proposal was named "E3" to signify that this would be the third evolution of the Library's computing architecture.

The goal of E3 was to develop and implement a new computing architectural model that would be sustainable over the long-term to meet the Library's need for flexible application offerings through code manipulation, increased reliability through the reduction of failure points, and cost containment while eliminating 3-year cycle purchases and MS-related expenses.

The objectives listed below would be achieved by migrating both client workstations and servers from Microsoft Windows to Linux:

- Develop a user workstation experience that contributes to individual education and research goals
- Reduce Total Cost of Ownership (TCO) by 50%
- Develop a foundation for long-term technology infrastructure planning
- Provide a long-term technology funding strategy.

Our measures for success include the following:

- Public workstations would provide core Library resource services
- The Total Cost of Ownership would be reduced
- A diskless workstation environment would improve reliability and performance.

Today

The implementation of E3 has propelled Fletcher Library into the forefront of library technology applications. The most important result is our increased capacity to be responsive to the technology and research needs of our users with the resulting impact on their studies and research. Equally important, we will be more effective stewards of our equipment and time, implementing new technology that will not adversely affect our budget.

Future

TS&D has created a technology roadmap propelling E3 forward through 2007. The following table outlines the technology changes.

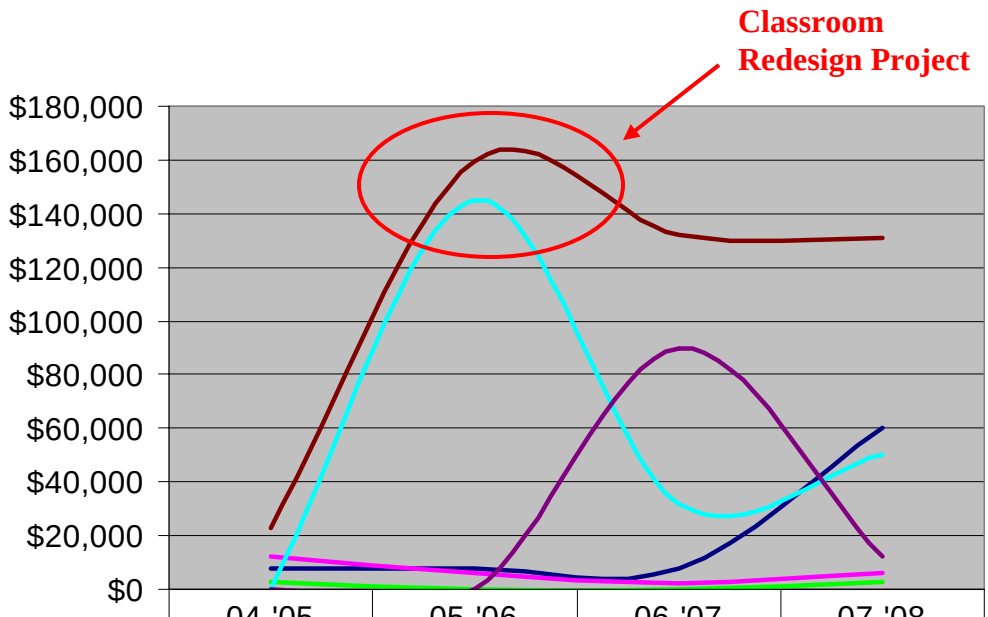
	Spring 2005	Summer 2005	Fall 2005	2006	2007
Public Machines	Version 2.0-ground up rebuild	Version 2.1-P2P technology for faster boot-time	Version 2.x image refresh and update Develop administrative tools	Develop Looking Glass for Version 3.0	Deploy Version 3.0
Servers	Refresh hardware	E3 Portal Server		Specify PAC 3.0 server requirements	Implement new servers
Circulation	Version 2.0		Version 2.x image refresh and update	Version 2.5	Version 3.0
Classroom	Define image	Develop image	Version 1.0	Version 2.0	Version 3.0

We have developed and will be using version 2.0 of a public machine image in Spring 2005 and will implement an E3 portal server for information sharing and development among other libraries, with the project and information exchange starting in the summer of 2005. Development of administration tools will begin in fall 2005 to simplify administration and application of the E3 system by other organizations. In 2006, a major change in the overlying desktop environment will start with the implementation of the Sun Looking Glass 3-dimensional desktop environment with a deployment target date of 2007. By 2007 all client systems should be unified with a standard base architecture and platform with customized options for specific application needs. These plans are intended to enhance the user experience, further cost-containment, and maintain current applied computing technologies.

Project Looking Glass Desktop Environment Examples

Estimated Budget Requirements Chart

Average =$111,350 per year



	04-'05	05-'06	06-'07	07-'08
Public Machines	$8,000	$8,000	$8,000	$60,000
Servers	$12,000	$6,000	$2,000	$6,000
Circulation	$3,000	$200	$200	$3,000
Classroom*	$0	$145,000	$32,000	$50,000
Library Staff	$0	$0	$90,000	$12,000
Total:	$23,000	$159,200	$132,200	$131,000

* includes classroom redesign project spending