FROM NETWORK TO ENTERPRISE LAB: PREPARING STUDENTS FOR E-BUSINESS

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ABSTRACT

To prepare information systems (IS) students for today's complex world of e-business, IS faculty must provide meaningful experiences that integrate a multitude of products and technologies. Such experiences require a laboratory environment in which students can analyze and solve a wide-range of real-world problems that employ different hardware, software, and network components. This paper describes one institution's endeavor to transform its existing network laboratory to a center for building enterprise solutions. On-going problems such as time demands, frugal budgets, technical support, and logistics are considered.

Keywords: information systems curriculum, computer laboratory, e-commerce, enterprise solutions

INTRODUCTION

Simulating today's e-commerce environment in the classroom is a tremendous task. Providing information systems (IS) students with the types of multi-platform, multi-product, integrative experiences they will face in the work world can be costly and complex. In the early 1990s, most IS programs were just exploring client/server applications and local area network environments. E-business now requires the use of software, hardware, and communications equipment unheard of in most curriculum laboratories a decade ago.

Information systems faculty are faced with preparing students for the increasingly complex technological world in which they will work. For today's business environment, IS programs need a laboratory facility that provides relevant hands-on experiences in the use of enterprise technologies. The purpose of this paper is to describe one program's experience in transforming its network laboratory to an enterprise facility for building today's business solutions.

IS SKILLS IN TODAY'S E-BUSINESS ENVIRONMENT

Today's IS graduates face a world of work that expects professionals to be literate in a wide-range of technologies. Athey and Plotnicki (1) analyzed newspaper advertisements to determine job opportunities for programming languages, database skills, infrastructure skills, networking skills, and other miscellaneous technologies. They concluded that their study "reinforced what many IT educators have anecdotally known for some time. The IT field is expanding into many new technologies but very few 'older' technologies are really disappearing."

Maier, Clark, and Remington (5) examined the change in skills and knowledge requirements as defined by classified advertisements over four decades. The average number of skills per ad increased from 2.63/ad in the late 70s to 3.50 in the mid 90s (increased diversity). Results also

suggested "that while education is important, experience may be the most sought after characteristic."

Chaudbury and Rao (2) also examined the change in IS skill sets over time by examining the evolution of platforms from host-based to client-server to Web-based. As shown in Table 1, each stage of the evolution process brings changes in the nature of interface devices, databases, communications, and architectures used in developing information systems. As platforms have changed, so have the skill sets required of IS professionals. Chaudbury and Rao identify specific tools required for today's Web-based environments according to the IS professional's role.

Research confirms that the skill sets of IS professionals will continue to grow in size and complexity as the e-business paradigm emerges. Graduates of IS programs face a world in which (1) new technologies must be learned while old technologies are still used; (2) the number of skills required continues to increase; (3) experience is highly valued; and (4) skill requirements change with evolving platforms. Information systems faculty are charged with providing meaningful learning experiences that prepare students for the dynamics and demands of their future careers.

Table 1. Evolution of Platforms (Chaudbury and Rao, 2000)

Type of Platform	Interface Devices	Databases	Communications	Architecture
Host-based	Character	Relational and hierarchical	Slow speed WAN	1-tier
Client-server	Graphical	Relational	High speed LAN, Private WAN	2-tier
World Wide Web	Multi-media	Relational, object	WANs over telephone lines	n-tier distributed platform

BACKGROUND OF THE PROJECT

During the 1999-2000 academic year, the CIS faculty in our College of Business conducted an extensive review of the information systems major. To meet the general education requirements of AACSB, the major is limited to seven courses. The old program required coursework in: (1) Visual Basic, (2) COBOL, (3) Web development, (4) hardware, systems software, and communications, (5) database management, (6) systems analysis and design, and (7) systems development.

The faculty agreed that the information technology/network component of the curriculum needed expansion. To accomplish this, the COBOL programming course was deleted as a requirement of the program. The redesigned curriculum structure is summarized in Table 2. Students complete a two-course sequence in both application development and information technology

during their sophomore and junior years. Three courses taught at the 400-level integrate concepts and skills taught at the 200 and 300 levels.

Table 2. Structure of Revised Curriculum

Scope of Focus	Year	Application Development Course	Information Technology Course
Personal/Workgroup problems	Sophomore (200-level)	Visual Basic	Intro. to information technology (with LANs)
E-commerce/enterprise	Junior (300-level)	Web Development	Enterprise technology management
Integrative experiences	Junior/senior (400-level)	Database management, systems analysis and design, systems development	

DEVELOPING THE LABORATORY ENVIRONMENT

The CIS curriculum is supported by both departmental and university laboratories. University labs traditionally support the application development, database management, and systems courses. These courses primarily require access to software for building applications that can co-exist with other software the university supports.

The CIS departmental laboratory supports the IT-based courses. These courses require a risk-free environment for exploring technological solutions. Students must freely manipulate the hardware, system software, and network configuration. Examples of projects conducted in the CIS lab might include:

- Installation of a peer-to-peer or client-server LAN network,
- Performance testing of various network configurations, or
- Implementation of a security plan.

In each of these cases, students need to alter network configurations, operation systems, and other elements of a comprehensive solution.

The revision of the IS curriculum dictated a change in the orientation of the departmental lab from simple network to complex enterprise solutions. Table 3 summarizes some of the major differences in lab focus between the old and new programs. In the old program, students never really ventured beyond the basic network problems and solutions. With the addition of a second IT course in the curriculum, students progress to examining multi-dimensional problems that involve multiple product and multiple platform solutions.

Table 3. Network vs. Enterprise Lab Orientation

	Network Lab (Old Curriculum)	Enterprise Lab (New Curriculum)
Scope of Use	One course, multiple sections	Multiple courses, multiple sections
Operating Systems	Single client/Single server	Multiple client/Multiple server
Network Components	Hubs, switches	Routers
Solutions	Primarily single-product	Integrated, component-based
Services	Basic file and print	Application, Web, messaging, database, and e-commerce

Upgrading laboratory resources and facilities to meet the demands of the new curriculum is a high priority. The current network lab, a former typing room for the office administration program, must now accommodate over 100 students/semester. The space is cramped, inadequately ventilated, and difficult to negotiate.

Plans are in place to remodel a large lecture room as an enterprise lab. The lab will provide a suitable learning environment for designing and implementing multi-product, multi-platform solutions. The plan calls for workstations to be organized in clusters of six for effective teamwork and teacher-student interaction. In a problem scenario, the clusters can be used to organize students by department, by region, and so on. Each workstation houses at least one PC with sufficient capacity to act as either a client or server.

A key consideration in designing the new space was the co-existence of multiple courses and classes that use different platforms and problem scenarios. In a single semester, the lab serves two to three separate sections of the introductory course as well as two to three sections of the advanced course. Several design features are included in the plans to minimize interference problems and increase flexibility of the workspace:

- Workstations are equipped with removable hard-drive drawers. Students simply insert their own hard drive with operating environment at the start of each class session.
- One cluster of workstations is designated for setting up special projects.
- KVM (keyboard, video, mouse) switches are used at some workstations to reduce space requirements and facilitate testing with multiple operating systems.
- A server station is available that can accommodate up to four servers for projects that require on-going, centralized server access.

The new laboratory will become operational during the Fall 2001 semester.

SOFTWARE SELECTION

The CIS laboratory always operates within a limited budget. Software choices are influenced by cost considerations. A primary goal of the CIS program is to provide students with a broad-range of experiences. To do this cost-effectively, the authors heavily rely upon evaluation copies of software that can be acquired for little to no cost. Evaluation software typically expires after 90-120 days. Since this is the timeframe for a semester course, evaluation copies usually meet the needs of the curriculum. If a particular configuration needs to carry over from one semester to the next, a fully-licensed copy of the software is acquired.

The current software inventory is shown in Table 4. Most products are probably familiar to the reader. The BackOffice Suite includes the following components for architecting solutions (4):

- Windows NT (file, print, and Web services),
- Exchange Server (robust messaging),
- SQL Server (relational database engine),
- SNA Server (mainframe connectivity),
- Site Server (large-scale web site management), and
- System Management Server (inventory, metering, software distribution).

As the table suggests, the focus of the introductory course is depth of exposure. Laboratory assignments are fairly structured to ensure that students master basic concepts and skills. The advanced course emphasizes breadth as well as depth. Students are expected to spend significant time on their own to complete course projects.

Table 4. Current Software Inventory

	Intro. to Information Technology	Enterprise Technology Management
Client side	Windows 2000 Professional	Windows 2000 Professional, Windows NT 4.0, Linux
Server side	Netware 5.1	Windows 2000 Advanced Server, Windows NT 4.0 Server, Linux, Microsoft BackOffice 2000, Commerce Server 2000, BizTalk 2000

Relying so heavily upon a single vendor (Microsoft) in an academic environment is a concern. Faculty members do not want to appear as if a particular vendor's solution is being promoted. However, the authors believe a single-vendor emphasis is acceptable for the following reasons:

- Time and complexity. In the second course, students are exposed to a variety of products within a short period of time. Working with software from the same vendor minimizes the learning curve as each new product is introduced.

- Reality. Microsoft is one of the major players in the "servicification" of software (3).
- Other solutions in other courses. Several courses in the curriculum also expose students to other vendors' products, e.g., Oracle and Novell.

One benefit the authors have found in using Microsoft-based software is the large number of case studies available on the Microsoft Web site (5). Instructors can find short, readable cases to illustrate the types of problems for which specific software products are appropriate

PROBLEMS AND ISSUES

At the time of this writing, the new curriculum is still being conducted in the old laboratory with major space limitations. Many problems that exist simply due to space constraints will disappear when the new facility becomes available. Currently, five sections of classes that represent two different courses and about 100 students share a lab that was originally designed for a single typing class. With the space problem solved, many difficulties still remain.

Multiple Courses and Instructors

The new facility will better handle multiple classes performing different laboratory assignments concurrently. However, plenty of opportunity still exists for different courses under different instructors to interfere with each other. The faculty must constantly coordinate their laboratory activities and assignments.

Instructor Preparation Time

As the number and complexity of technologies increases, so does the preparation time for the instructors. Time is always needed to learn new product features and functionality. In a multi-product environment, more problems can occur that require additional debugging time. Additionally, there are no true textbooks and supplemental materials for integrative approaches in the lab. The instructor is on his/her own.

Technical Support

Good technical support is critical to the success of the laboratory environment. This is probably the biggest challenge for the authors at this point in time. Support for the lab is traditionally provided through graduate assistants. Unfortunately, the college's graduate students are all MBAs with little to no technical expertise. The authors plan to request student wage money to hire a senior-level CIS student who has completed both IT courses.

Budget

Funding for the lab historically has come from the college's operating budget. The laboratory is vulnerable to reductions in funds whenever a budget crisis occurs or priorities. The faculty members want to work with the dean to find external sources of money to support operation and future expansion of the facility.

All of these problems are inter-related. For example, if the technical support problem is solved, preparation and coordination times will decrease. The authors are hopeful that administration support will continue as efforts are made to enhance the laboratory.

SUMMARY

Information systems faculty are faced with preparing students for the increasingly complex technological world in which they will work. For today's business environment, IS programs need a laboratory facility that provides relevant hands-on experiences in the use of e-commerce technologies. The purpose of this paper was to describe one program's experience in transforming its network laboratory to an enterprise facility for building today's business solutions.

A revision in the IS curriculum dictated a change in the orientation of the departmental lab from simple network to complex enterprise solutions. In the old program, students never really ventured beyond the basic network problems and solutions. With the addition of a second IT course in the curriculum, students progress to examining multi-dimensional problems that involve multiple product and multiple platform solutions.

A new lab space will be available in Fall 2001 to support the revised curriculum. Evaluation copies of software are used whenever possible to minimize the cost of resources. The new laboratory environment requires more coordination and preparation time on the part of instructors. Good technical support is critical for long-term success of the lab.

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