New Approaches for Compensating the Information Technology Knowledge Worker

Partnership in Supporting Computer Technology at Emory University

Developing an Information Technology Support Model for Higher Education

Information Architecture: The Data Warehouse Foundation

Taming the Internet for Electronic Data Interchange via a Secure Server

Plus:

Internet2: Building and Deploying Advanced, Networked Applications

A Framework for Universal Intranet Access

Are Software Publishers in Touch with Higher Ed Needs?

Seven Points to Overcome to Make the Virtual University Viable

Intellectual Standards in the Information Resources Industry

Colorado Community College and Occupational Education System
CAUSE/EFFECT
A practitioner’s journal about managing and using information resources on college and university campuses
Volume 20 Number 2 Summer 1997

CURRENT ISSUES

4 Internet2: Building and Deploying Advanced, Networked Applications
by Ted Hanss, Internet2 Project

FEATURES

8 New Approaches for Compensating the Information Technology Knowledge Worker
by Celeste M. Giunta, the California State University System

17 Partnership in Supporting Computer Technology at Emory University
by Marisa Johnson, Julia Leon, and Susan Mistretta, Emory University

24 Developing an Information Technology Support Model for Higher Education
by Richard M. Kesner, Babson College

31 Information Architecture: The Data Warehouse Foundation
by Charles R. Thomas, National Center for Higher Education Management Systems

41 Taming the Internet for Electronic Data Interchange via a Secure Server
by David H. Stones, University of Texas at Austin

VIEWPOINTS

48 A Framework for Universal Intranet Access
by William H. Graves, University of North Carolina at Chapel Hill

53 Are Software Publishers in Touch with Higher Ed Needs?
by Glen McCandless, Focus Marketing, Inc.

55 Seven Points to Overcome to Make the Virtual University Viable
by G. D. Bothun, University of Oregon

58 Intellectual Standards in the Information Resources Industry
by Mark Sheehan, Montana State University

GOOD IDEAS

61 Learning about Distance Learning
by Andrew C. Lawlor and Jeanne Rodier Weber,
Edinboro University of Pennsylvania

34 CAMPUS PROFILE
Colorado Community College and Occupational Education System

On the cover: The futuristic Education Technology Training Center of the CCCOES is one of the most comprehensive multimedia production sites in the U.S. The Center is the latest effort of the largest postsecondary education system in Colorado, which reaches over 200,000 students across the state each year. Pictured above is the videoconferencing room for the central System offices in Denver, part of a network used to connect presidents and executives of member colleges, and to coordinate management of dispersed information technology resources.

DEPARTMENTS

2 From the Editor

3 CNI Report
Changing Economics of Scholarly Information
by Richard P. West

64 Recommended Reading

66 Readers Respond
Student Services on the Web
Nearly twenty years ago, CAUSE/EFFECT was launched to address issues of interest to higher education information systems professionals and to provide them a vehicle for professional development through publication. Back then, CAUSE had just been redefined as The Professional Association for Development, Use, and Management of Information Systems in Higher Education. Content focus in those early journal days revolved around the importance of information systems to managing colleges and universities, especially to strategic planning and support for decision-making.

While those issues are still of concern to CAUSE members, in more recent years, CAUSE/EFFECT, like the association, has broadened its purview to the management and use of information resources—a term the association adopted in 1994 to encompass information and services, as well as technology. Among today’s professional challenges are the following:

1. The need to restructure central information technology organizations to better accommodate user support in a distributed technology environment, including partnering with departmental technology support personnel and restructuring IT job designs and classifications.

2. The need to promote and develop an institutional technology architecture, as well as an institutional information architecture, based on campuswide standards, to facilitate support, access, authentication, encryption, directory services, electronic commerce, and so forth.

3. The need to integrate planning for information technology into the institutional planning process, to ensure congruence with academic program directions as well as institutional strategies for reengineering administration.

4. The need to rethink current models for financing the acquisition of information resources, given technology life cycles and the increasing digitization of information resources, and to develop cost models for the delivery of technology-based education on and off campus.

5. The need to address the myriad policy issues that arise in the rapidly changing networked information environment.

Articles in this issue of CAUSE/EFFECT address a number of these management challenges, beginning with Celeste Giunta’s update on the information technology job design and reclassification project begun by the California State University System three years ago and now fully implemented. Her article provides lessons learned that should be helpful to other campuses seeking to change their IT personnel structures.

Two other articles focus on new technology support models. Babson College has established a “peripatetic help desk” support staff who roam the halls providing local help, while at Emory University a new Indirect Support Team has revolutionized the concept of supporting local technology support staff by improving communications with and building a community of such staff; informing, empowering, and training this community; and promoting the growth of this local support model throughout the University.

Charles R. Thomas, CAUSE’s founding executive director, has contributed an article to this issue in which he advocates the establishment of an institutional information architecture as the basis for a campus data warehouse initiative. He laments that too often data warehouse projects are begun as departmental initiatives rather than to support an enterprise-wide approach to information resources management.

Finally, David Stones offers a description of the server that the University of Texas at Austin has established to provide higher education institutions a convenient and secure mechanism to use electronic data interchange standards for exchanging student transcripts via the Internet. His article encourages institutions to take the steps necessary to make secure electronic commerce a reality in student services in the near future.

In addition to this issue’s features, half a dozen other articles offer informative and/or challenging perspectives on a number of current concerns—from Internet2 applications and new models for software licenses, to issues raised by virtual universities, universal network access, and intellectual standards in our industry.

One closing note that may explain the somewhat nostalgic opening of this column... Having been the editor of this journal for fifteen years, I am about to turn over the reins to CAUSE’s incoming Director of Publishing and Communications Services, James Roche, former senior editor at the American Association for Community Colleges. As Jim begins his editorial reign this month, please welcome him and send your comments and suggestions for CAUSE/EFFECT and other publications to jroche@cause.org. It has been my pleasure—and a wonderfully rewarding experience—to edit and publish CAUSE/EFFECT through the years. I look forward now to new challenges as CAUSE’S Director of Research and Development, and to working with Jim and my other colleagues at CAUSE to continue the association’s dedication to delivering high-quality products and services.

Julia A Rudy, Editor
The Changing Economics of Scholarly Information

by Richard P. West

CNI grew out of a heritage of information technology applied to librarianship. This is not the characterization I usually make about CNI’s beginnings. More often, I think of the Internet as having been the innovation that provided the transport that allowed information to be brought to the reader. However, the Internet was simply the most recent, albeit perhaps the most powerful, of the innovations in information technology to be applied to the needs of the traditional library. Libraries provided a safe storage place for all types of information, but particularly printed information. Having acquired information, libraries spent a considerable amount of their resources in providing ways of finding and using the information stored in the physical library. The library card catalog was the most important way that library users determined the information available for use. Keeping track of information materials on loan to patrons was another library function that was amenable to information technology. Out of earshot of my librarian friends I describe the library automation efforts as an application of a large inventory control problem—organizing, filing, searching, storing, and tracking the use of a very important and scarce resource—the scholarly information acquired by our institutions.

I give this very brief and very simplified version of the successes in library automation to segue into another CNI theme, which is about the change in scholarly communication. The digitization of scholarly information, with the introduction of successful and easy-to-use finding tools, introduces significant opportunity for change. Just as earlier applications of information technology to library functions improved the traditional services of our campus library, the ubiquitous national and international network sets the stage for significant change. At times I have been frustrated by the rate of change we have been able to create in the scholarly communication process. I see the opportunity for savings and improved services, but it seems we often continue to persist in old behavior in spite of these clear opportunities.

Demonstrating ways of harvesting the benefits of this change has been characteristic of CNI projects and programs. The economics of networked information, including shifts among cost centers that deal with scholarly information, is one such project. One obvious example of this shift is that one copy of an article can serve a world-wide base of users. No longer is the information geographically bound, nor does it need to be rationed by the physical availability of a limited number of copies. The opportunity to have the world’s information content immediately available is obvious. But what is technically possible does not automatically become an implementation.

The selection of the scholarly materials to be purchased by research and education libraries has always been a critical role of librarians. Collection development librarians see many more opportunities for acquiring scholarly materials than the collections budget permits. Rationing has always occurred. So it continues in our digitized, networked-information world. The cost of the basic resource is still the limiting factor. We need to find ways to place more of our institutional information services budget into the acquisition of the rights to use information.

CNI as well as other projects have indicated that there are certain market conditions in the scholarly journals marketplace that indicate—in lay shorthand—an insufficient supply in the good old supply and demand model. The best articles are contained in a limited number of journals. Price of these journals can be increased without affecting total revenue received. That is, although some cancellation of subscriptions occurs while price goes up (which is what one would expect) there are enough libraries willing to pay a higher price for the journal to make up for the publisher’s revenue loss from canceled subscriptions. Changes in intellectual property rights—at the core of changing the scholarly communication process—will be required to change the economics of the distribution of scholarly information.

This debate around the changing economics of scholarly communication and the value provided by the entities in the distribution chain—scholars, publishers, brokers of information, institutional and individual buyers—has been a very productive CNI theme.

(continued on page 30)
Internet2: Building and Deploying Advanced, Networked Applications

by Ted Hanss

The Internet2 Project, a consortium effort of over 100 universities, is investing in upgrading campus and national network platforms for such application areas as digital libraries, collaboration environments, tele-medicine, and distance-independent instruction. This article provides a brief overview of the project, details issues that the project application effort intends to address, and outlines how you and your institution can get involved.

The Internet2 Project mission is to “facilitate and coordinate the development, deployment, operation, and technology transfer of advanced, network-based applications and network services to further U.S. leadership in research and higher education and accelerate the availability of new services and applications on the Internet.” The emphasis of the project is on more than fast data rates. Internet2 will provide new network functionality through differentiated levels of service. Quality-of-service functionality will lead application developers to enhance current applications and create applications that were not previously possible. Internet2 (I2) will ensure, on an end-to-end basis, that applications have the network resources they require. However, the broadest goal goes beyond building a network or deploying individual applications—we seek to establish a distributed knowledge system for achieving innovations in research, teaching, and learning.

Project overview

Internet2 is driven by its charter members, consisting primarily of research universities. In addition, not-for-profit affiliates, government agencies, and industry members participate in I2. While focused on U.S. needs, the I2 project works closely with related international efforts to help build a common, global approach to advancing networked applications for research and education.

Many of the same participants were involved in the NSFnet project through the ’80s and early ’90s. After NSFnet was privatized, a series of planning meetings focused on the needs of higher education: Would the commercial Internet be able to meet the demands of leading universities? The feeling was that for commodity Internet services, the market was investing appropriately in building and deploying infrastructure. However, the needs of the research and education community went beyond the functionality of the Internet as defined in the mid-’90s. With over 3,000 U.S. Internet service providers focused on meeting the exponential demand for Internet connectivity, the higher education community needed to take the lead in moving Internet functionality to the next level.

In October of 1996, thirty-four universities attended a meeting at which the Internet2 Steering Committee (established earlier in the year) described the objectives of the project; all of the universities in attendance committed to moving the project forward. Shortly thereafter President Clinton and Vice President Gore announced the administration’s Next Generation Internet (NGI) initiative. The Internet2 Project has responsibility for Goal 1(a) of the NGI goals (see sidebar), and is a key participant in addressing the other goals.

By January of 1997, more than 100 universities had joined Internet2. Committing to I2 means investing locally to build applications and upgrade the campus networking infrastructure and contributing toward the central project effort. Each I2 member institution appoints an executive point of contact, an applications lead, and an engineering lead.

Who benefits from Internet2?

The universities that have joined the project to date have faculty and researchers with leading-edge needs for early access to Internet2 functionality, as well as the institutional ability to fund the necessary network upgrades and applications development. Thus it is a self-selecting group of universities with pressing demands for advanced networked applications who will benefit initially from I2.
Colleges and universities and other organizations with less immediate needs for I2 applications and services, who are not participating in the early investment, will benefit as well. A key objective of I2 is accelerating the technology transfer necessary to move the appropriate new technologies into the commercial marketplace, thus creating the basis of next-generation services available to all sectors of society. However, it is not necessary to wait for integration of Internet2 services into the commodity Internet for all institutions to benefit. The Internet2 Project will also share its experiences and expertise on an ongoing basis with others in the education community and beyond. Through publications, presentations (at CAUSE conferences, for example), and workshops and focus groups open to non-members, the I2 Project will provide updates and interaction with a wide community of interest.

This overall approach characterized development of the first Internet and it can work again today. In the late 1980s, approximately 100 universities participated in NSFnet. Within three years, NSFnet access extended across higher education. The Internet2 Project is establishing the structures to repeat this process.

Over the past decade, federal government R&D agencies, the higher education community, and private companies have worked together to develop many of today’s Internet technologies. That partnership created a multi-billion-dollar industry. By renewing this partnership, Internet2 will develop and implement new technology needed by all network users, ensuring continued U.S. leadership in research and education.

Applications: examples and issues

The focus of Internet2 is on enabling applications. It isn’t possible to forecast all the applications we will see, but a sample of what we’re working on today will give a flavor for the future:

- Digital libraries featuring streaming high-fidelity audio and video content, large bitmap scanned images that appear instantaneously on the screen, and new forms of data visualization.
- Collaboration environments that encompass virtual laboratory support, remote instrumentation, session record and playback, easy-to-use real-time discussions with audio, video, text, and every window having “whiteboard” features.
- Immersion environments, supporting new forms of collaboration through three-dimensional, virtual shared presence.
- Music instruction with high-fidelity, multi-channel, multi-party audio and video; interactivity, to support ensemble playing and music/dance improvisation; and synchronization of audio, video, and annotations.
- Tele-medicine, including remote diagnosis and monitoring.
- Computation- and data-intensive applications, such as the correlation of physical and social science data involved in evaluating population movement in the context of a region’s climate changes.

There is not a straightforward route to these new applications—we will rely on serendipity and the creative abilities of faculty, researchers, staff, and students on our campuses. There is much we don’t know yet about user needs, much less what is technically possible. Therefore, it’s most useful at this time to describe the areas we intend to explore in the project.

Quality of Service. A necessary investigation is defining user requirements for quality of service (QoS). Audio/video services may require bandwidth reservation, electronic commerce must have transactional guarantees, collaborative applications demand real-time services, and so on. Dependability and reliability are critical quality parameters for all applications. Are these all that we need? More than we need? And what is the appropriate level of quality of service? For example, is “best effort” (today’s Internet capability) versus “guaranteed QoS” a binary choice or a graduated scale? More choice provides greater flexibility, but perhaps differentiated ser-

---

Next Generation Internet (NGI) Initiative

✓ Goal 1: High-performance Network Fabric
(a) The networks developed under the NGI Initiative will connect at least 100 NGI sites—universities, federal research institutions, and other research partners—at speeds 100 times faster than today’s Internet.
(b) The NGI networks will connect on the order of ten NGI sites at speeds 1,000 times faster than the current Internet.

✓ Goal 2: Advanced Network Service Technologies
The NGI initiative should develop and demonstrate all the advanced network service technologies needed to support next-generation applications.

✓ Goal 3: Revolutionary Applications
A fundamental objective for the NGI is to demonstrate a wide variety of nationally important applications that cannot be achieved over today’s Internet.
vice levels need to evolve over time given current router performance.

**Network-Aware Applications.** Today, applications are typically not aware of any attributes of the underlying network. Can we create network-aware, adaptive applications that adjust their functionality as network conditions change? How do applications determine they are getting the QoS requested? As we assume the Internet Protocol (IP) as a common bearer service, what emerging IP extensions can applications exploit (e.g., the resource reservation protocol, RSVP, and IPv6) and what further extensions must be made? Stable application programmer interfaces must be defined to assist application developers in accessing necessary QoS features.

**High Fidelity Audio and Video.** Standards-based transport services for streaming audio and video are emerging. However, a proliferation of proprietary encoding schemes will lead to needing different client packages to access content from multiple sources. The Internet2 Project should explore non-proprietary approaches to encoding video/audio content at high data rates.

**Tools.** Many of the utilities we use today were developed with assumptions of congested networks with small maximum transmission units. For example, researchers using very large data sets have identified improvements in the file transfer protocol (FTP) as a place where a relatively small investment could result in large productivity gains.

**Collaboration Infrastructure.** To build effective collaboration environments, we must address mediating control among participants, displaying arbitrary content on any screen with whiteboard overlay, synchronizing data streams, and session record and playback. Industry may address some of these challenges. However, the higher education community could focus on its interests, including integrating control of remote scientific instruments.

**Multicast.** The goal of efficient delivery of data to wide audiences through multicast is understood and valued. However, much work remains to make multicast a viable, productive mechanism for one-to-many and many-to-many applications. Many engineering challenges related to routing and management must be addressed. Another area for exploration is use of wireless (e.g., satellite) delivery of multicast streams. There are also opportunities for the I2 Project to sponsor content streams. This might include establishing “channels” for publishing not just audio and video content of interest to the higher education community, but such lower bandwidth content as environment-sensing data.

**Infrastructure Components.** Internet2 is not intended to solve current Internet problems. However, barriers remain to deploying advanced applications. Security is a critical distributed systems component, along with directory services and electronic commerce. Inter-realm authentication is needed to deploy digital library applications accessible across institutions. In addition to the technical challenges, there are policy issues for which I2 could be a testbed. For example, what are the most appropriate costing and charging schemes for reserving particular quality-of-service attributes?

**Exploiting GigaPoPs.** The topology of the I2 network includes GigaPoPs—gigabit capacity points of presence—which serve as regional aggregation points. GigaPoPs improve traffic efficiency through local packet exchange, but they also provide a location for caching or replicating servers for Web, database, and file systems access. For example, digital video content for asynchronous learning may be staged at GigaPoP-based servers, and GigaPoPs could host local down- and up-link satellite facilities providing economical, nationwide multicast delivery of telemetry data, audio and video streams, etc.

**Scaling.** A distributed environment with international applications connectivity must support large numbers of simultaneous users per application and millions of users overall. Thus, we must undertake application-level modeling efforts with such inputs as user behavior, quality-of-service attributes, and caching strategies. The modeling will consider the number of simultaneous users per application and the number of simultaneous applications per campus and per GigaPoP. From this, we can refine the design of applications and set expectations for the growth of network capacity.

**User Interfaces.** The above issues focus on exploiting lower layers for enhanced applications functionality. The user interface, though, will be the critical test of success. Do users establish their own preferences for quality of service? If so, how is it presented? What are the user perception issues for dynamically adjusted QoS? Information visualization research is key to deploying enhanced digital libraries. Collaboration-enabled applications require investigations into shared work tools, while tele-immersion adds the challenge of how to simulate realistic shared presence.

**Application area objectives**

The application area priorities for 1997 are identifying requirements for quality of service and establishing a demonstration showcase for exemplary I2 applications. A number of other
goals are forecast for the first three years of the project (see sidebar). While some of these goals are quite aggressive, they provide a sense of the initial priorities of the effort.

**The network**

Internet2 will have a physical, production network that allows for application experimentation. That is, the network will be a stable and reliable platform for application developers. Regional affiliations of universities will come together at the GigaPoPs mentioned above. The initial interconnect network for the GigaPoPs is the NSF-supported, MCI-provided very-high-speed backbone network service (vBNS). The vBNS today runs at OC12 rates (622 megabits/second). Most universities will connect at OC3 (155 megabits/second), with some connecting at T3 and others up to OC12.

The network engineering effort has a set of principles that illustrate the applied, versus basic, research aspects of the physical network:
- Buy rather than build
- Open rather than closed
- Redundancy rather than reliance
- Basics before complexity
- Production rather than experimentation
- Services to end users, not among commercial providers

**Readying your campus for Internet2**

If you’re already a project member, there are two major components to readying your campus for Internet2. First is supporting faculty and other developers of advanced applications. These will include investing money and people in local applications development, joint development with other members, and participating in project working groups exploring the issues described above. The project will identify applications that illustrate the potential for I2 through demonstration, and that provide a basis for exploring open technical issues.

The second component is upgrading the campus’s physical network to support inter-institutional, end-to-end broadband connectivity for these new applications. The specific requirements for the campus network are the responsibility of the campus and are not determined by the project.

If your campus is not a member of the Internet2 Project, you will probably want to follow the various I2 activities as they evolve in the coming year, learning from your colleagues’ experiences and adapting your own campus plans accordingly. The official Internet2 Web site at http://www.internet2.edu/ offers many documents, status reports, and presentations that can keep you up to date about Internet2 activities.

**Conclusion**

By exploring these applications issues in a production-focused environment, we hope to identify the best practices and best applications that will meet the needs of the higher education community today and in the future. We also intend to focus heavily on effective technology transfer. We will not succeed if we’ve created a network just for colleges and universities. As with NSFnet, our success will come by the universal adoption of I2 functionality by the business and consumer markets as well.

---

**Application Goals**

**1997 Goals**

- Document application requirements, including the services we expect from the network.
- Establish a set of “network services” assumptions, a forecast of what’s possible and when
- Put on one to two demonstration showcases
- Conduct inter-campus application trials
- Perform quality-of-service experiments
- Undertake tools/utilities enhancements
- Construct application-level network models

**1998 Goals**

- Place initial applications in production
- Conduct advanced application trials (e.g., immersion environments)
- Make first QoS toolkits available
- Put on several large-scale demonstrations
- Instrument systems for input to network modeling efforts

**1999 Goals**

- Put advanced applications in limited production
- Place initial QoS-enabled applications in production
- Realize production deployment of international application collaborations
- Gather real-time data for network/application simulations

“The official Internet2 Web site ... offers many documents, status reports, and presentations that can keep you up to date about Internet2 activities.”
New Approaches for Compensating the Information Technology Knowledge Worker

by Celeste M. Giunta

In the spring of 1996, the California State University systemwide office implemented a new classification series and compensation structure for its information technology professionals. Development of this project, which affected more than 1,000 union employees, took five years of discussions and negotiation. This article reviews the process and describes the compensation structure, union negotiations, and lessons learned.

Three years ago the California State University systemwide office (CSU) shared information about a new job design approach for information technology professionals in a CAUSE/EFFECT article. The goal of the new approach was to accommodate changing skill requirements, promote ongoing skill development in information technology jobs, and enhance organization effectiveness by optimizing the use of the available skill mix. The CSU faced numerous challenges in implementing the new approach given its size, diversity, and the fact that information technology professionals are represented by a union.

At the time the article was published, the CSU had completed the classification and compensation design and development phases of the project and was on the verge of negotiating with union representatives the compensation changes necessary to support the new approach. That article presented trends for change that influenced the job design and provided an in-depth discussion of the job design process and outcomes, but did not address the compensation proposals because of their confidential nature at the time.

In the spring of 1996, after five years of development, discussion, and negotiations, the CSU began to implement the new information technology (IT) classification series and supporting compensation structure—an effort that has affected over 1,000 employees. This article shares the final phases of the project, describing the design and development of the compensation structure, negotiations with the union, implementation, and lessons learned.

Project background and update

A formal study to explore alternative job design approaches for information technology jobs was initiated in 1991. The impetus for the study came from both outside and within the CSU. External pressures for change resulted from shrinking state funds and resources, coupled with expanded demands for educational access and accountability for technology services. Additionally, the CSU was strategically reorganizing and decentralizing decision-making and budget authority to individual campuses. Likewise, information technology departments on individual campuses were becoming increasingly decentralized and diverse in terms of management philosophy, organizational structure, information infrastructure, and resources. This complex diversity alone mandated job design flexibility.

Information technology managers were frustrated by existing job structure limitations, which resulted from the CSU classification structure. The classification and its associated salary structure were seen as barriers to effective work and utilization and development of human resources. Employees also expressed frustration at the limited opportunities for growth and performance recognition. As is common in most public entities, CSU classifications were narrowly defined, task driven, and hierarchical. The companion salary ranges were based on seniority and composed of narrowly defined step ranges. Together, these structures could not be readily adapted to the dynamic nature of today’s information technology work environment.

As the CSU explored job design alternatives, it identified a fundamental need for an informa-
tion technology job structure that would give managers flexibility in work assignment and resource management. More specifically, managers needed flexibility to achieve desired goals by assigning work in a way that expedited its completion and optimized the use of the available skill mix. The job structure needed to be supported by an equally flexible, market-competitive compensation structure that provided greater opportunity to promote and reward performance and development on the basis of competencies and skills valued by the organization.3

Negotiating these fundamental compensation changes was the biggest challenge and obstacle to implementation. Fortunately, CSU executive leadership articulated and stood behind a newly developed staff compensation philosophy and set of goals that supported the new approach. This commitment was crucial to the resolution of the negotiation process and to the ultimate implementation of the new IT classification series.

Chief among these goals was a pay-for-performance plan for all employees represented by collective bargaining agreements, including faculty. The commitment to pay-for-performance was viewed as essential for the successful implementation and administration of broader, more flexible salary ranges designed to support the IT job design. The specific goals identified for CSU staff classification and compensation were to:

- provide management flexibility to develop positions and employees and assign work through the development of broader, functionally-based classifications and broader, open salary ranges;
- create a pay-for-performance structure that allows managers to recognize and reward performance, development, and contribution;
- enhance employee opportunities for skill development, cross training, and promotion; and
- maintain a competitive job and salary structure to recruit and retain a highly qualified and productive work force.

The project was organized into four key phases:

**Data collection.** The purpose of this initial phase was to define goals, prioritize issues, gather internal job data, and conduct external research. Information was gathered through position questionnaires and focus groups with constituent groups.

**Design and development.** Based on information collected in phase one, a conceptual design was developed. To build consensus and ensure an operationally successful approach, the conceptual design was refined by partnering with two committees. The subject expert team helped troubleshoot job and skill requirements from a technical perspective. The human resources team worked to troubleshoot the approach from a classification perspective.

**Negotiations.** Once the classification and compensation structures were developed and management approval obtained, negotiations with union representatives began. Negotiations broke down and ended when the parties reached an impasse largely as the result of overall compensation goals and initiatives, not specifically the IT series. After exhausting the collective bargaining process, including mediation and fact finding, management made the decision to unilaterally implement the new IT series along with other compensation changes.

**Implementation.** The implementation process took a full year. It involved systemwide joint training of human resources and information technology managers on the new classification and compensation structures, as well as the individual campus processes for making determinations that moved employees into the new structure.

**Job design approach.**

The job design model developed by the CSU evolved based on the two key goals identified in the data collection phase: flexibility and skill development. The key design strategy to addressing both goals was to focus on broader job functions and common skill sets, rather than specific job tasks. This strategy was consistent

---

### Table 1: Classification series for information technology

<table>
<thead>
<tr>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyst/Programmer</td>
<td>Performs analysis and development of systems and technology-based solutions to meet user needs, including applications, databases, and related systems.</td>
</tr>
<tr>
<td>Operating Systems Analyst</td>
<td>Performs operating systems analysis and maintenance, including network and database systems, and their interfaces to all other systems.</td>
</tr>
<tr>
<td>Information Technology Consultant</td>
<td>Provides a broad range of consultative support to students, faculty, and staff to enhance the use of technology systems and information access.</td>
</tr>
<tr>
<td>Network Analyst</td>
<td>Engineers, analyzes, and supports all networks carrying voice, data, video, and/or broadcast transmissions.</td>
</tr>
<tr>
<td>Equipment/Systems Specialist</td>
<td>Installs, modifies, and maintains equipment and systems, with a hardware and systems configuration focus.</td>
</tr>
<tr>
<td>Operations Specialist</td>
<td>Operates, monitors, and controls multi-system information systems in data, voice, and/or video processing.</td>
</tr>
</tbody>
</table>

---

3 Swan and Giunta, 36-37.
with human resources trends identified in the external research and provided the opportunity to expand job recognition to include the contribution of the individual.

Frustrated managers can probably count the times they have heard a human resources representative say “we pay for the job, not the person” when trying to recognize a top performer. The reality is each individual brings a unique contribution to his or her job and disregarding this contribution has always been problematic. Jobs don’t define people, but people often define jobs because people, not jobs, accomplish work. As work continues to shift away from a set of discrete, ongoing tasks to “whatever it takes to get the work done” to meet workplace demands, the role of the individual and his or her competencies becomes even more central to the accomplishment of work and determination of pay.

Focusing on functional differences allowed the CSU to collapse the information technology community from over twenty discrete classifications into six broad classifications inclusive of all job levels (see Table 1 for a brief description of each). Figure 1 illustrates how the old classifications were collapsed into the broader classifications with skill levels.

Creating broad classifications inclusive of all job levels, rather than traditional discrete, incremental classifications, provides for the essential flexibility and skill development. First, the approach is more suited to information technology knowledge workers because it broadens the focus from job content and scope to include the knowledge, skills, and contributions of the individual doing the work. The term knowledge worker refers to the fact that much of the work in information technology is performed in the mind using a varied, abstract knowledge base. Often work cycles are long and complex, making it difficult to get a snapshot of the full depth and diversity of the work. As a result, traditional, static job definitions do not capture the full essence of information technology work. Second, as a position evolves or individual skills develop, the approach provides the opportunity for more natural, fluid growth and development without artificial job-level barriers. Finally, changes in work assignments are readily accommodated without an immediate need to review classification or level assignments.

Based on the analysis of existing work through the data collection process, only three distinct levels were clearly distinguishable within each of the six classifications:

- **Foundation.** This level encompasses a narrower range of skills and pay appropriate for entry level positions through proficiency.
- **Career.** This level encompasses a broad range of skills and pay from proficiency to senior career and is intended to accommodate the majority of employees through most of their careers.
- **Expert.** This level is reserved for the top technical echelon; complexity and strategic orientation characterize work at this level.

While the CSU program utilizes skills and competencies to define levels within the broadly defined classifications, it is not a true skill- or competency-based program. Skill- and competency-based programs are “person-based,” rather than job-based. This means that pay is based strictly on a repertoire of skills or competencies (see definitions) that are performed by the person, and increases to base pay are based on the addition of skills sets or competencies. True skill/competency-based plans do not measure job tasks or content for pay determination.

In the CSU model, skill requirements and development are key factors for progression within a broad classification, but job content is still the main determinant of pay. The CSU program is more of a job-based, skill/competency-influenced approach designed for information technology knowledge workers.

To support the administration of the three broad skill-based level definitions, skill-level guidelines were developed. These include three core skill/competency dimensions that were identified as critical to successful performance in information technology work: (1) technical know-how, which encompasses depth, breadth, and integration of knowledge, (2) critical think-
ing skills, which cover problem solving, future thinking skills, and organizational, self, and project management, and (3) interactive capabilities, which include listening, communication, team, and leadership skills. (See Table 2 for excerpts from skill-level guidelines for professional level positions.)

Position skill requirements, as defined by management, are the primary determinant of skill level within an IT classification. Specific skill requirements are compared to the skill-level definitions and guidelines to determine the best level fit. The "person in level" concept (see Figure 2) is applied to determine the incumbent's eligibility for growth within and between skill levels. Movement to a higher skill level is based first on the need for a position at a higher level, and second on an incumbent's abilities. In the public sector, this is seen as a critical budgetary control mechanism.

**Broadbanded compensation structure**

The foundation of traditional compensation structures is the job—a set of discrete tasks and skills. As the nature of jobs and work continues to change and expand in the workplace, compensation structures need to evolve and adapt. Traditional, rigid salary structures designed to limit discretion are outmoded and are being replaced by more flexible, innovative programs, which place the art of managing back into the hands of the managers.9

As the CSU became clearer in its job design approach, the need to overhaul its compensation structure became paramount. Broader classification and skill levels did not fit with the existing structure of narrow ranges with a 20 percent spread from the minimum to the maximum rate and defined steps. Additionally, salary progression through this step structure was essentially automatic, provided satisfactory performance was maintained. This left little opportunity to recognize or reward differences in contribution or promote development. Changes to this compensation structure had to be negotiated with the union.

**Creation of career bands**

To support broader jobs and recognize a greater variability in individual skills and competencies, a broadbanded compensation structure was the logical alternative. Most organizations introducing skill/competency-based or -influenced programs rely on some form of broadbanding. It is a compensation strategy designed to provide a broader view of work and more readily accommodate variable levels of skill, performance, and progress by significantly expanding the spread between the minimum and maximum rates of a salary range. Generally, broadbands are implemented when an organization seeks to decentralize and streamline pay administration and promote lateral career growth.

Typically, organizations that implement true broadbands define four to six salary bands for the entire organization. Each band encompasses major occupational groupings and the full spec-

---

**Table 2: Excerpts from skill-level guidelines**

<table>
<thead>
<tr>
<th>Skill Level</th>
<th>Foundation</th>
<th>Career</th>
<th>Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Know-How</td>
<td>Basic knowledge of specialty area with limited ability to integrate elements within the specialty.</td>
<td>Functional, working knowledge of specialty area. Capable of integrating skills and knowledge from other specialties.</td>
<td>Advanced and comprehensive knowledge of specialty area. Capable of substantial integration from other specialties to achieve innovative results.</td>
</tr>
<tr>
<td>Critical Thinking Skills</td>
<td>Capable of solving problems where precedents exist. Refers others appropriately.</td>
<td>Applies theories and principles and uses reasoning and logic to analyze problems, explore alternatives, and implement the appropriate solution.</td>
<td>Understands problems from a broad, interactive perspective. Is able to develop and implement solutions that combine information in new ways.</td>
</tr>
<tr>
<td>Interactive Skills</td>
<td>Able to present ideas clearly in writing and orally.</td>
<td>Competent at interpreting and communicating information, ideas, and instructions.</td>
<td>Demonstrated expertise using persuasion and negotiation to build cooperation to expedite projects.</td>
</tr>
</tbody>
</table>

---

trum of job levels. For example, the first band may include all non-exempt office support jobs; the second all non-exempt technical jobs; the third exempt professionals; the fourth management; and the fifth executives.

Broadbands can have a spread from the minimum to maximum rate of the band of 70 percent to 150 percent. Usually, to be considered a true broadband, the spread is at least 100 percent. This compares to traditional salary ranges that typically have spreads of 40–60 percent. The concept of defined steps is antithetical to the basic premise of broadbands, which are designed to accommodate variability. Within a broadband, however, an organization may define pay zones based on various skill or market factors to assist in pay administration.

The broadbands utilized by the CSU are more accurately described as career bands because they are based on a job family. Each IT classification is essentially a job family inclusive of all job levels within that family. A key consideration in the job design and compensation structure was to provide for lateral growth and development—a characteristic often associated with career bands.10

The individual career bands for each classification were developed based on a market study. The starting point for developing each career band was the midpoint. It was targeted to the statewide market rate for the fully proficient level within each classification. Statewide rates were used because the same structure applies to all twenty-two campuses and the chancellor’s office location.

The spread from the minimum to maximum rate for each career band varies from 90 percent to 145 percent, based on the statewide market rates identified for the job family encompassed within the broad IT classification. The four professional level classifications (analyst/programmer, operating systems analyst, network analyst, and information technology consultant) have the same minimum and maximum rates. The small differences in proficiency rates identified for the different classifications in the market study were not meaningful in the context of broadbanding.

Additionally, sub-ranges are defined within the career bands for each of the three skill levels. The sub-ranges were developed by matching the criteria defined at each skill level to job levels with comparable knowledge and skill requirements in the market. The sub-ranges associated with each skill level are comparable to the approach of developing pay/skill zones to assist in managing pay within broadbands.11 In the CSU structure, each skill level sub-range overlaps with the adjacent sub-range by 10–20 percent. This is primarily to account for varying entry qualifications and to allow for continuing recognition of performance and development within a skill level without inappropriate skill level advancements.

Figure 3 illustrates the career bands and sub-ranges that comprise the IT compensation structure. The career bands have spreads ranging from 90–145 percent, based on market rates. Likewise the sub-range spreads vary and are noted in parentheses.

Movement through the career bands
Currently, as a result of negotiations, movement through the bands occurs as the result of three types of salary increases.

---

10 Ibid., 7.
(1) **Performance-based salary increases.** These are individual salary increases from a pool negotiated with the union. They are granted based on performance and each campus has the discretion in the distribution of this pool. Campuses must use their allocated performance pool, but may also supplement this pool at any time in any amount to recognize an individual.

The performance-based salary increases are the only variable component in the current compensation package. They allow for the recognition of contribution, which includes skill development and acquisition, taking on of new assignments, as well as traditional performance factors. The flexibility of this compensation component is viewed as essential to the success of the new classification and compensation structure.

(2) **Service-based salary increases.** These are salary increases that recognize service and are of a specific percentage negotiated with the union. They are granted to eligible employees with satisfactory performance on their anniversary date. As Figure 3 shows, employees are eligible for service-based salary increases only up to the midpoint, or fully proficient rate, within the overall classification range. The rationale behind this is that employees at the midpoint and above are being paid at a fully proficient level, and future salary increases should be based solely on demonstrable performance and development.

(3) **In-classification progressions.** When an employee advances to a higher skill level, this is referred to as an in-classification progression. At that time, an employee must receive an increase to the minimum of the new sub-range or of at least 5 percent. The criteria for advancement to a higher skill level are discussed under the job design.

(4) **General salary increases.** In addition, general salary increases are used to maintain market competitive salary ranges and pay. Because uniform percentages are applied to the salary ranges and individual salaries, there is essentially no movement within the salary band as the result of a general salary increase.

Managing costs is a central concern when broadbands are implemented. Within the CSU program there are several built-in control mechanisms. First, employees are only eligible for service-based salary increases to the midpoint of the career band. Second, skill-level sub-ranges identify market-appropriate pay zones for various job levels. Finally, and most critical, management has budget accountability for the distribution of pay-for-performance funds.

**Negotiations with the union**

Gaining union acceptance of a new approach to classification and compensation is challenging; the CSU process took a total of three years. Initially, the union representing employees in IT classifications refused to bargain regarding the impact of the new series. By the time the parties reached the negotiation table, the process coincided with full contract negotiations for the bargaining unit covering IT professionals. This meant the new IT series was only one of several key management initiatives for change proposed to the union. Foremost among these initiatives was pay-for-performance. As mentioned, this initiative was viewed as critical to the successful implementation and administration of the new series, but was also a major stumbling block in the negotiation process.

Once negotiations began, considerable energy was devoted to educating union representatives on why the CSU wanted to make these changes and how the new structure would work. Through this process, the union expressed some positive reaction to the new opportunities available to employees, but were guarded about the concept of management discretion and differ-
Managers who had wanted flexibility suddenly had it, but had few tools and little experience to make it work.

After negotiating for several months and exchanging numerous proposals related to the compensation structure and other unrelated management initiatives, negotiations broke down and the parties requested to be certified for mediation. The mediation process was not successful either, and the negotiation process was taken to the final step of fact finding. This process involved a fact-finding hearing with representatives from the CSU, the union, and an impartial third party. Unfortunately, the parties were still unable to reach an agreement through this final step.

Recognizing that the collective bargaining process had been exhausted without resolution, CSU executive leadership elected to unilaterally implement the proposed contract provisions in the spring of 1996. These provisions included a new compensation structure for all classifications, pay-for-performance salary increases for all classifications, and the new IT classification and compensation structure. Subsequently, through another round of negotiations, the union agreed to the compensation structure and salary increases were successfully negotiated in the summer of 1996.

Chief among the union’s concerns with the new IT structures was management discretion and potential favoritism (exactly what traditional structures are designed to minimize) and adverse impact on employees. The union had a very broad interpretation of adverse impact. It sought guarantees that no employee would be placed at what was viewed as a lower level, and assurance that employees would not experience reduced pay opportunity as a result of a skill-level placement.

In the implementation process, CSU limited adverse impact to no individual employee’s salary being reduced. If a campus found through the implementation process that an employee’s salary was at a higher level than the skill level determined, they were encouraged to work with the employee on a development plan to bring performance and pay into alignment.

Working through negotiations to address these concerns and maintain some safeguards in the contract (such as service-based salary increases and seniority rights) was key to the ultimate success of reaching an agreement. However, the chief factor leading to an agreement was executive leadership’s commitment to their position. Their willingness to move to unilateral implementation for the first time in the history of the CSU had a dramatic impact. They were committed to making compensation changes they believed were critical to the future of the University and effective management.

Implementation and training

The new classification and compensation approach introduced a new way of thinking about people, jobs, and pay that was in conflict with traditional, comfortable practices. Just as ongoing communication was critical during the negotiation process, it became even more critical at implementation. Managers who had wanted flexibility suddenly had it, but had few tools and little experience to make it work. The new approach dramatically changed the roles in the classification and compensation process: human resources shifted from a directive to a more consultative role; line managers had to become more active and accountable in making classification and pay decisions; and employees had to become more self-directed in supporting their own development and career growth.

Because of the significance of these changes, many felt that implementation should be delayed until a complete new infrastructure was in place. However, it is clear now that if the CSU had waited, implementation would never have occurred. The classification and compensation structural changes have supported strategic initiatives and are proving to be a driver for further change.

Campuses were given complete flexibility in the implementation process, but were invited to training sessions sponsored by the chancellor’s office. Because of the technical nature of IT jobs and impact of the change, it was deemed essential to jointly train human resources and information technology managers on the new structures. Campus representatives were encouraged to attend the training in teams. The training effort was substantial and the first of its kind within the CSU system, but still only a first step.

The training sessions were a combination of lecture, campus work sessions, and roundtable discussions. The key goal was to introduce the new approaches to classification and compensation and provide examples of best practices to assist campuses in developing their own administrative processes and procedures. Tools were provided for developing new position descriptions and making skill-level determinations. Other topics included communicating the changes to employees and supporting performance management processes.

Another key goal of the training was to open dialogues within and among campuses. Through the training sessions, campuses began to develop
their own implementation strategies and plans. Many campuses chose to use implementation committees made up of central computing managers, decentralized computing staff, and human resource representatives to ensure equity and develop new campus processes. Feedback on the committee process from most campuses was positive. Many noted that implementation had gone more smoothly than anticipated. A couple of campuses reported committees having difficulty effectively reaching decisions or consensus on placement of employees within the new structure. Each campus is unique and needed the flexibility and opportunity to develop its own solution.

The author's experience in working with one team is illustrative. Initially, managers on the implementation team struggled with the new concepts. Significant time had to be devoted to discussing the concepts and working definitions so that they made sense in their environment. Ultimately, it was the practical applications that made the concepts come to life. Managers were almost surprised when they realized they had finally made the decisions necessary to place employees in the new structure. The process of gaining a comfort level was difficult, and at times unsettling, but once achieved, most managers commented on the relative ease of the new structure.

The need to continue the training and support process is apparent, particularly in the areas of compensation and performance management. As discussed in the previous article, these are essential supporting systems for longer term success and to achieve the original goals of the program to improve organization effectiveness.\(^12\)

Lessons learned

Looking back, the lessons learned at the CSU focus more on the change process itself than on the actual design features. This is similar to the findings of Hewitt & Associates in their study of organizations implementing broadbands, in which they noted that the design is not as critical as the organizational readiness for change.\(^13\)

Key lessons learned to date in the change process include:

- **Senior management support and commitment are pivotal.** For the CSU, these changes were monumental, and tremendous hurdles had to be overcome in the collective bargaining process. None of the changes would have occurred without executive leadership’s commitment and support. This was articulated in the compensation philosophy and goals and consistently demonstrated in their willingness to go the distance with the various unions representing CSU employees. In the case of the union representing employees in IT classifications, the CSU exhausted the collective bargaining process and went to unilateral implementation to achieve its goals.

- **Change takes time; resistance should be expected.** Fundamental change takes time, and once the momentum is gained it is important to keep moving forward. Many of the managers impatient for change and flexibility were not prepared when it was delivered. When the new structure was first introduced, along with other change initiatives, such as pay-for-performance, the experience was overwhelming, and many had difficulty assimilating all the changes. The sudden responsibility and accountability seemed daunting. Ongoing training, communication, and support are essential to facilitating change.

- **Management training and communication are essential.** As Abosch and Hand point out, “In the simplest terms, broadbanding puts the job of managing back in the hands of managers.”\(^14\) At CSU, managers had been working for years with a rigid classification and compensation system that severely limited discretion. Broader classifications and career bands provide increased discretion and flexibility to recognize individual contributions. On the other hand, it engenders greater accountability to the budget and employees. Managers need training and support to meet the new demands of this accountability. The CSU is working to provide more support in this area with very limited resources.

- **Testing or piloting are well worth the effort and promote success.** Testing can be helpful in troubleshooting potential implementation and operational problems. The initial CSU job design had specific skill requirements defined for each skill level within a classification. Through the process of testing the initial model against sample positions, it became clear that the model had replaced one kind of rigidity and specificity—job tasks—with another—job skills. The specific skills were found to vary so much from one campus to another that this model was untenable. Through the test process and work with the subject-expert team, broader criteria were developed which became the skill-level guidelines. This proved to be a turning point during the development phase.

> “…the design is not as critical as the organizational readiness for change.”

\(^{12}\) Swan and Giunta, 43-44.

\(^{13}\) Abosch, 10.

\(^{14}\) Ibid., 16.
come outdated before they are even implemented. In the CSU, several smaller components of the original design lost their relevance or importance during the long development, negotiation, and implementation process.

When entering into a change process of this magnitude, it is important to be willing to expect and tolerate problems. It is nearly impossible to reach perfection before implementation of broad change initiatives. The important thing is to learn from challenges and continue to move ahead. Being nimble is more important than being perfect.

- Employee development and skill currency needs to be a shared responsibility. When introducing a job and compensation structure with a focus on development, there need to be clear communications to employees to manage their expectations. The position of the CSU is that development must be a shared responsibility in a learning environment where employees take an active responsibility for their own development, and managers take on the role of coach.

Key lessons learned to date in the compensation program design include:

- Stick to qualitative approaches, avoid quantitative methods. The goal of broader, functionally-based classifications and career bands is to provide flexibility. When organizations are used to more precise systems, quantitative methods can creep in, and “quasi-precise” systems often emerge. In the early development phase, the CSU explored some quantitative methods, such as a percentage system, for skill-level determination. It was a time-consuming process that proved inaccurate and got in the way of good judgment. Validating a quantitative method is difficult. Focusing on qualitative scales and behaviorally anchored skill/competency descriptors is more efficient, flexible, and defensible.

- Compensation opportunity needs to be real. Part of the difficulty faced by CSU is the lack of control over salary increase funding. The CSU receives an allocation from the state each year for operations. The University trustees determine what portion of the allocation will be set aside for compensation negotiations with the union. Negotiations determine the funds available for salary increases.

A successful program must have mechanisms for recognizing all the components of contribution—taking on increased responsibility, applying new skills, and work performance. Without these mechanisms, the basic premise of the program is missing. The CSU must rely on its current pay-for-performance program for rewarding contribution and performance. The campus flexibility to supplement these funds is an essential component foundation for the program.

- Labels can be obstacles. Most employees are comfortable with the skill level titles of career and expert, but foundation has proven to be a more difficult sell. Some managers are reluctant to use the level for any but the initial entry level. Unfortunately, this could lead to another version of “grade creep,” which is moving to a higher level based on factors other than skill or performance. The more neutral the labels, the better.

Looking ahead

A more formal evaluation will occur over the next twelve to twenty-four months as the CSU evaluates the longer term viability of the new approaches and structures and makes revisions based on lessons learned. At this point, there is no going back, only moving forward. The CSU’s new classification and compensation flexibility are hard-earned achievements, and the hope is that both the CSU and employees will benefit over time: the CSU with a more highly skilled and versatile work force improving organization effectiveness, and employees with improved skills, enhanced opportunities, and increased job satisfaction. The next generation of programs is already under way as the approach is fine tuned based on lessons learned. The CSU will be using similar approaches to revise and update other classification series.

For further reading:


Compensation and Benefits Review, a journal published by the American Management Association (see http://www.amanet.org/).

See the Web site of the American Compensation Association at http://www.ahrm.org/aca/htm

Acknowledgments:

The author would like to extend special thanks to Dr. Thomas W. West, Assistant Vice Chancellor for Information Technology at the California State University System, for his original vision and support; to Dr. June Cooper for her leadership in making the new structure a reality; and to all the campus information technology and human resources managers for their valued contributions to the development of a new structure and their energy during implementation.
Partnership in Supporting Computer Technology at Emory University

by Marisa Johnson, Julia Leon, and Susan Mistretta

Information technology use at Emory University has experienced exponential growth over the past decade. This article describes Emory’s radical rethinking of how information technology users should be supported.

More than twenty years ago, Emory University created a fledging computing center to support the growing needs of computing-intensive departments across the institution. Within a few years, the newly named Emory University Computing Center (EUCC) was supporting the mission-critical administrative jobs, such as registration and payroll, and the academic needs for statistical and time-sharing computing at a rapidly growing university.

By 1989, the increasing need for desktop support and the desire to integrate voice, video, and data technologies became the driving factors in Emory’s creating the position of Vice Provost for Information Technology and molding EUCC into the new Information Technology Division (ITD). In the early 1990s under the direction of the new vice provost, ITD began studying and implementing a Total Quality program. As part of that effort, staff from senior management to data center operators were trained in facilitation methods, customer service, and decision-making. Task forces and working groups across ITD were formed and began using the principles of focusing on the customer, making decisions based on data, creating a team environment, and striving to continuously improve. The practice of listening to the customer became a priority; no longer was ITD willing to act as the sole center of computing expertise at Emory. Slowly ITD was being “transformed” from a hierarchical to a flatter organization, with more self-directed teams of employees. Although this newfound flexibility to customer requests improved the quality of service, it was not enough to keep up with the number of requests for computer solutions—Emory had become a community of 15,000 computer users.

Rapid growth was now a fact of life. In just a few years, the campus had moved from a centralized, mainframe-based computing organization to one that supported a variety of desktops, network connectivity, and software. The explosive distribution of computing technology across campus was straining ITD’s ability to provide central support—backlogs for hardware repair, software installation, and consulting were reaching two weeks or more. Campuswide surveys that analyzed the state of support for desktop and departmental computing told the tale: customer satisfaction with ITD was dropping, and in many instances, departments had hired their own “computer experts.” Although this departmental expertise varied widely, it had become apparent that ITD’s role in supporting office systems had changed forever.

In some cases, ITD employees feared this loss of central control and the possible loss of their jobs. Would the existence of local support mean the dissolution of a central computing organization? What was ITD’s role in a campus of more independent and more knowledgeable users?

These questions and concerns culminated in a division-wide reorganization in January of 1995. In a presentation to the entire staff, the vice provost articulated his vision of a new and more responsive organization. Among the reasons for reorganization were the overwhelming demands for service and the need to support those persons in their departments who provide frontline computing support. In other words, local support personnel were to be our colleagues and not to be seen as threats to central computing. Part of achieving these strategic goals was the creation of the Indirect Support Team.

The Indirect Support Team:
Goals and Accomplishments

The initial charge of the Indirect Support Team was to put processes and procedures in place that would help local support personnel to be successful and computing users on campus to
already had [local campus units nearly sixty support] staff.

Surprisingly, 18 graduate division. Research Center; and Oxford business; the Yerkes Primate nursing, public health, and of medicine, theology, law, sciences; professional schools graduate school of arts and Emory University encompasses a tion to Emory College, the graduate students. In addi-

1 Emory University is a private, Methodist-affiliated university with more than 11,000 undergraduate and graduate students. In addition to Emory College, the University encompasses a graduate school of arts and sciences; professional schools of medicine, theology, law, nursing, public health, and business; the Yerkes Primate Research Center; and Oxford College, a two-year undergraduate division.

Identification and documentation

It became apparent that improving communication between local support and the Information Technology Division staff would have to wait until the Team identified and defined who and what constituted the local support community.

In the first months after the Indirect Support Team’s formation, the members drew up a list of all University departments and identified which of these departments had local support personnel. Surprisingly, nearly sixty campus units already had such staff. In many cases, these people had not been hired as computing experts, but rather had been “assigned” computing support tasks. At this point, Team members interviewed each and every local support provider and began building a Web-accessible database of these individuals, including information about their computing environment and their areas of expertise.

The biggest beneficiaries and most active users of this organized information have been the staff at ITD. Whether browsing this database to double-check knowledge about a department’s local computing environment or using the names of local support personnel as an authoritative list for granting access to particular servers, ITD staff working in desktop, network, and central server support have found this database of enormous and unexpected value to them.

Building the local support community

After identifying the names and numbers of local support personnel across the Emory campus, the Indirect Support Team turned toward building a community of local support personnel with an eye toward the central goal of improving communication. The Team decided that the focus in building a community or communities of users would be establishing user groups, which might be “meeting user groups” that actually meet face-to-face, electronic user groups that only “meet” in e-mail conversations, or spe-

Meeting user groups

As mentioned above, these user groups meet face-to-face on a regular basis to discuss current issues and share experiences. Over the past two years, the Indirect Support Team has formed a number of these groups and plays as active a role as is needed to get a group started—as much as possible, the Team encourages the users to take on the responsibility of planning the agenda for the meetings.

The formation of a meeting user group requires a good deal of background work. A member of the Team chosen to initiate a particular group polls the community to create a list of people with whom to seed the group, then develops the initial programs, including selecting a topic, inviting a speaker, finding a time and place to meet, sending out invitations, and arranging refreshments. These hosting activities are essential to the operation of a meeting group and are an activity that was not managed well prior to the Indirect Support Team’s creation.

The Indirect Support Team currently facilitates these meeting user groups:

- Emory Apple Community
- Emory Digital Users Group
- Emory Computer Lab Managers Group
- Emory Data Warehouse Users Group
- Emory LAN Administrators (ELANA)
- UNIX System Administrators Group at Emory (USAGE)
- Emory Windows NT User Group
- Emory WWW Developers Group
Electronic user groups

The primary example of an electronic user group at Emory is the entire local support group, defined and developed as one of the Indirect Support Team’s initial activities as described earlier. A Web site maintained by Team members includes, among other things, a listing of all local support pages and keyword searching of this database.

In addition, a listserv distribution list is maintained with e-mail addresses generated from the local support database. This list is often used by local support personnel to share information on current problems and ask questions of their local support colleagues. Finally, telephone numbers from the database are loaded into voicemail distribution lists for the Team that are then used to quickly inform all local support personnel of central system alarm messages—for example, a network failure on the campus backbone.

These tools of electronic communication are also used by the Indirect Support Team as a way to centrally and consistently inform the Emory community about ITD activities, about other user groups on campus and in the Atlanta area, and about user groups that are forming. The minutes, handouts, or presentations of active user groups in which the Indirect Support Team participates are also published on the Team’s Web site.

Special interest groups

Interest is generated for these groups by announcing their formation on a Web page that contains a form for users to register their interest. The names of individuals gathered during this process are used as a listserv distribution list to inform group members when an opportunity for a special meeting or formal activity arises. The Indirect Support Team has initiated three special interest groups: Document Imaging, Mathematica, and Statistics.

Informing the local support community

Along with building communities of users, the Indirect Support Team is charged with informing the Emory community of technology users about ITD news and activities that may affect them. Historically, the tendency within ITD has been to not inform users of anything until the message is perfectly edited and certain. Too often, this was too late! Through the use of published World Wide Web pages, electronic mail, phone messages, and office visits, the Indirect Support Team has become a focal point for local support personnel when they need information about ITD. The by-product of this two-way communication is a growing trust between the local support community and ITD.

The largest and most public means of informing local support personnel has been the semi-annual conference hosted by the Indirect Support Team. These conferences generally attract 100-150 participants. The conferences begin with a luncheon and presentations by keynote speakers such as the University president, University provost, and the vice provost for information technology, and participants then attend several presentations during the remainder of the afternoon. In February of 1996 and again in March of 1997, the conference was set up to accommodate both novice and advanced local support personnel by creating a number of sessions conducted by ITD staff on the technologies available to the Emory campus as well as those technologies that were “up and coming.” In October 1996, the conference highlighted local support achievements by having local support personnel themselves conduct presentations and demonstrations of projects they were working on. Ranging from “Fax Solution for an Office” to “World Wide Web Publishing,” these topics were informative and continued to emphasize the notion that ITD was a central, but not the only, place for computing expertise at Emory.

Empowering the local support community

The Indirect Support Team works to empower the local support community by acting as an advocate for local support with regard to ITD procedures and policy issues. With the organization of the local support group on campus, the Indirect Support Team helped to focus the voice of local support personnel, which now carries significant influence and is heard throughout ITD.

There are several large-scale distributed computing environments on campus, representing the University’s professional schools, libraries, and affiliates. In these areas a manager and staff provide full-time computing support and, frankly, have earned a more direct communication channel with ITD. The Indirect Support Team facilitated the startup of a special committee for these local support personnel and the top level management of ITD, including the vice provost. Known as the Technology Advisory Committee (TAC), they meet monthly to discuss high-level policy issues as well as ways of integrating services and cooperating on projects.

The Indirect Support Team’s constant and consistent advocacy of the local support position brings the customer’s point of view into every internal ITD meeting. One example of this
advocacy was the changes to ITD’s procedure for users to obtain PPP accounts. Some customers on campus were finding this procedure difficult and unresponsive to their needs; discussions within a small local support group pointed out that a significant process problem existed. The Indirect Support Team suggested that a subcommittee meet to articulate the problem and propose a desired solution. A member of the Team worked with the group to facilitate their discussions and advised them on how to best present their request to ITD. Finally, the Indirect Support Team arranged for ITD’s senior management to review the proposal, which was then approved and sent to ITD’s UNIX system administrators for further refinement.

Though this example was eventually successful, the Indirect Support Team has determined that it is not enough for the Team to act merely as a go-between for ITD staff and local support personnel—the Team must bring them together as partners.

Another recent example of the importance of the Indirect Support Team’s advocacy of local support issues was the plan between the computing organizations of both Emory’s health care system and the University to purchase Novell support for the entire campus. Management teams in both areas had planned to funnel all contact for Novell support through four authorized people. The community of Novell administrators represented by one of the user groups nurtured by the Indirect Support Team saw this as an unworkable solution and, as a group, was able to convince management to purchase the option that allows the campus to provide Novell a long list of authorized contacts. Emory’s Novell administrators can now choose to be on this list or not.

Finally, the Team realizes ITD staff might perceive a certain “danger” in empowering local support personnel. By giving out information about ITD and its efforts, the Division can become open to complaints and criticisms from some very vocal people, and these comments can be very uncomfortable for ITD staff, who may have been insulated from this sort of input before, to receive and deal with.

But the Team’s experience suggests that this fear is unfounded. For example, the group that manages ITD’s UNIX servers has often come under criticism from the math/computer science department. On a particular Friday, the program for the UNIX system administrators meeting was a panel discussion on backup strategies, with panelists from ITD, math/computer science, and a research facility. As luck would have it, on the previous evening ITD’s server had had a hard disk failure, compounded by a RAID\textsuperscript{2} failure. On the day of the meeting, mail was unavailable to most of the campus while ITD restored the information from a woefully inadequate backup tape. What an opportunity for ITD to be buried under criticism yet again! But this wasn’t the case. Instead, the group of system administrators from all over the University offered to support the ITD staff in their request for the money needed for additional hardware.

### Training the local support community

As one might expect, the range of desktop expertise varies greatly among local support personnel. A major component of the Indirect Support Team’s work in their second year has been to assess and, if possible, formalize and standardize the training opportunities for local support personnel across campus. Since it is obvious that these individuals must have a basic, introductory knowledge about local networks and the desktop environment, the Indirect Support Team is using this assumption as a basis to begin working with them and the manager of ITD’s Short Course program to develop a training and certification program specifically for local support personnel.

The Team envisions that two or three levels of training (introductory, intermediate, advanced) can be developed to satisfy additional training needs of the local support community. Not only will such training improve communication between ITD staff and the local support staff they assist, it will also more clearly define what a local support person can be expected to know and do, and will provide a training- and perhaps a career-development path for local support personnel.

### Growing the local support community

Although ITD reorganized itself and ITD management bought into the notion of supporting local support personnel, the idea was not discussed with the entire University. Therefore, not every department or organization was in a position to hire local support staff and quite often these units didn’t see why they should be spending money on something that they thought should be provided free of charge by the central computing organization.

For those departments that express an interest in establishing local support, the Indirect Support Team works closely with them and Emory’s Human Resources Division in identifying job requirements, choosing appropriate job titles and grades, and, finally, interviewing likely candidates. In the past two years, several departments have set aside funds and hired their own

---

2 RAID (Redundant Array of Inexpensive Disks) is one way of creating a fault-tolerant storage system and encompasses six levels, ranging from byte-level striping to block level and parity data striping.
support staff, bringing the total local support community close to 140 people.

In a perfect world every department would see the benefit of local computing support and fund it. Then all of the support people would network with each other and central computing to get great things done. But this is not a perfect world. At Emory the undergraduate College of Arts and Sciences, which represents over half of the student population, is not positioned to hire and manage local support for the faculty in their departments. Given this dilemma, ITD and the Woodruff Library funded pilot projects that hired support people for the Social Sciences departments.

This model was continued for the 1996-97 academic year, during which six more local support staff were hired—three for humanities, one for biology, and two for history, philosophy, and economics. Although these local support people formally report to ITD, they are in practice the responsibility of a partnership among ITD, Woodruff Library, and Emory College: ITD provides the salaries, the Library provides a staff person to work with faculty on electronic information resources, the College provides office space, and all three entities participate in the evaluations of the local support person’s performance.

In each department’s case there is a backlog of basic computing and local network support to be handled. However, in hiring, we look for people who are not only computer technologists, but are also interested in supporting the mission of their particular department. The Team’s hope is that they will be able to work with faculty to use information technology to improve teaching and research at Emory.

Explaining the local support community to ITD

As mentioned earlier, the staff at the Information Technology Division have been important beneficiaries and active users of the local support database. Keyword searching allows staff to query the database to find specific, though unauthoritative, information such as the number of Novell administrators on campus, the number of users of a specific e-mail client, and the various counts on the number of users with either PCs or Macintoshs. In addition, the creation of an electronic mail distribution list for local support makes it a snap for ITD to send out important and timely announcements of scheduled computer downtime, software upgrades, or special hardware sales.

A new project for the Team’s second year was the promotion of an electronic polling system for local support that asks them for a list of their “hot topics” for the year. Many computing organizations can only guess about what is important for their customers, and often they guess wrong. This system allows the ITD leadership and staff to see exactly what local support personnel will be working on in the coming year and what topics hold the most interest for them. The Team uses this information to plan specific presentations for the various user groups and the semi-annual conference. In addition, local support staff are asked a series of more specific questions about the “winning” hot topic (which happens to be Remote Access/Telecommuting) that help specify what help or consultation local support staff need from ITD to make their work on remote access issues easier and more efficient.

**The Indirect Support Team: Team Skills**

By all accounts, the Team has been successful in changing ITD’s relationship with local support people. In no small part, this is due to several effective team skills present in Emory’s Indirect Support Team.

**Experience**

Experience in the campus computing environment and relationships with people across campus provided the knowledge necessary to get off to a good start. The three members of Emory’s Indirect Support Team have this experience. One worked in the library providing local support and for ITD as the initial contact for new customers; another worked for Emory Hospital before coming to the University, and at ITD had been the manager of the maintenance group for the payroll/personnel systems, had worked on a technical architecture plan, and had provided support with customer departments in the desktop environment; and the third worked as a mainframe programmer, the head of the training program, and as a manager with responsibility for the people doing LAN installations and PC database application development.

**Flexibility and initiative**

Since no one understands the job fully, team members have to be flexible enough to define their jobs as they go along, and they must be self-starters. When the Indirect Support Team was formed, there were no role models to follow. ITD management had an idea of what the Team should accomplish, but left it to the Team to determine the methods to use. To get rolling, members wrote a vision and supported the vision with a mission. The mission was refined by adding specific responsibilities and measurable actions for a six-month period. Now periodic

---

“...in hiring, we look for people who are not only computer technologists, but are also interested in supporting the mission of their particular department.”
tracking is done to measure progress on these actions and at the end of each six months the next action plan is developed. Although the Team is not constrained by its initial planning, this organizing work helped to define the Indirect Support Team in its infancy and at the very least was a valuable exercise in team building and consensus.

Quality methods and teamwork
The team practices methods for improving service quality in an organization. ITD has been studying the principles of Total Quality Management for several years. Although the Division has had mixed success, the Indirect Support Team embraces the idea of self-directed work teams. Being self-directed means that the team members must organize their activities and:
- plan how to work together,
- plan what to accomplish,
- figure out when to involve each other and when not to.

After nearly two years of working as a self-directed team, there continues to be very little friction. The Team has become a safe place for members to test out ideas, get feedback on sticky situations, and air frustrations. Possible reasons for the success are that Team members are located close to each other in an open office environment and have complementary skills, and three is an easily managed number for a team.

Facilitation skills
Good facilitation skills related to the quality methods are also necessary. All three Team members have exhibited competence with the facilitation techniques that ITD adopted. They have been trained in structuring different types of meetings to accomplish the sharing of knowledge, identifying group consensus, action planning, action tracking, and strategic planning. Since the University as a whole has not adopted these facilitation methods, the Team is often called upon to help others accomplish their goals.

Moderate technical expertise
Team members need moderate technical expertise so that they can be knowledgeable enough to understand the issues, but are not so technically oriented that they can’t refrain from providing the “perfect” technical solution. The Team’s job is not to recommend specific technologies or technical solutions, but to refer to other departments, vendors, and VARs (value-added resellers) for technical expertise.

Success of the Local Support Community
It is generally acknowledged that standardizing and doing support centrally is a cost-effective strategy. Is there any way that fostering distributed support and the expense of the Indirect Support Team can be justified? Here are a few stories that demonstrate the successes and wins for Emory because of the presence of distributed, local support.

Law School
In the spring of 1994 Emory’s Law School was not connected to the campus Ethernet backbone, but had allocated money for the connection, for internal wiring, and for some staff to work on jumpstarting and promoting the use of information technology at the School. During the summer, three people were hired who were graduates of the Law School with strong computer skills and no desire to practice law. Within short order, the wiring had been completed, desktops were connected, and the new support staff had established desktop standards for Law School faculty and staff.

There is no magic here. The Law School could have paid ITD for computer support and the Division would have been equally successful. But the three law/computer experts created something that central computing staff would not have envisioned doing—they developed tools to take electronic files of the decisions of Federal Court of Appeals and turn them into HTML (hypertext markup language) documents. They installed their own Web server to share these documents and negotiated with the courts to publish their decisions. Today the Emory Law Web posts decisions by the First, Fourth, Sixth, Seventh, Tenth, and Eleventh Federal Courts of Appeal and is one of the largest publishers of court decisions in the United States. The union of computer skills and discipline knowledge yielded something really creative—and unlikely to have been delivered by the traditional, centralized computing organization—in support of the mission of the Law School.

Office of Sponsored Programs
Another department that has benefited from local computing support is Emory’s Office of Sponsored Programs (OSP). This small office of fifteen gathers information on available grants and supports researchers in applying for those grants. In the late ‘80s the office had a full-time programmer on staff whose focus was providing tools for data management. In the early ’90s he left and OSP decided not to replace him, but instead to buy computer support from ITD. Dur-
ing that period they were able to maintain their database applications and network their computers, but saw no real gain in integrating the technology with the departmental business.

Just over two years ago, OSP again hired a computer professional. They found someone with database skills who was interested in exploring other areas of computing and information technology. Of special note was that part of his initial training was working at all the other jobs in the department so that he could understand the business completely.

One benefit of having a departmental computing professional is the obvious increase in productivity of other staff members. OSP’s local support person has facilitated this by proactively suggesting tools that meet their needs, by resolving problems immediately, and by taking care of the myriad things that need continual attention—virus protection, backup, security. Another key result of his efforts is the use of information technology to make the services of OSP available to researchers throughout the University.

Other perspectives

When local support personnel were asked by the Indirect Support Team what is important to them, they identified three areas in which the Team has been beneficial:

Community. Most often, local support personnel mention the user groups as being very effective in assisting them in their work. Communication among local support personnel has greatly improved since the Indirect Support Team began its work.

Central resource. The Indirect Support Team also connects local support people to the resources they need. For example, the Team helped find a single point of contact in ITD to answer a local support person’s questions. With the help of this contact, she has been able to assist her department in installing a network and implementing a local e-mail solution.

Empowerment. Finally, local support personnel use the Indirect Support Team to, as another support person says, “back us up.” She attributes the cohesiveness among the local support staff to the efforts of the Indirect Support Team and is able to point to specific decisions made by ITD’s leadership that were affected by the opinions of the local support community.

Overall, the Indirect Support Team has provided local support staff with a communication network that both ties them to ITD technical experts and puts them in touch with each other. Local support people use this communication to find answers to problems, get advice on products, and explore issues of common interest.

Particularly important are the relationships that have been fostered among local support personnel that have helped to alleviate the demand on ITD’s technical experts. Equally important is the fact that local support people have a different perspective on the technology than do the ITD experts. Whereas the Division’s perspective is more focused on the design of the technology, local support has a more practical view that focuses on how information technology is actually useful. There are times when talking with one’s peers makes sense and times when advice from a technical expert is needed. Our local support people have access to both.

Because Emory is a large community with remote sites, computing support staff don’t run into each other at the water fountain. Effort has to be spent to foster communication, or when it is needed it won’t be there. Managing user groups, facilitating conferences, and maintaining the tools for communication has to be a stated part of someone’s job. It cannot be left for someone to do when and if s/he gets around to it.

Conclusion

There are several reasons why the partnership between the Information Technology Division and the local support community has been mutually beneficial. ITD’s support staff are able to concentrate on the difficult, non-repetitive problems while looking to preventive and more strategic support strategies for the future. In addition, the different perspectives brought to computing support by both partners have made an impact on decision-making. The more practical view of computing that local support personnel hold is instrumental in ITD’s making balanced and useful strategic decisions for the direction of information technology on the campus.

Lastly, the partnership succeeds because three positions have been dedicated to focus on building and maintaining it. In the future, these same three staff may be assigned other jobs or spread throughout the organization, but for now it is acknowledged that someone must be dedicated and accountable for this work. Building partnerships is not a casual task, but a recognized and ongoing responsibility at Emory University.
Developing an Information Technology Support Model for Higher Education

by Richard M. Kesner

At Babson College, as at many other institutions, most of the College’s services are computer mediated, creating a demand for full support coverage by the help desk, which handles as many as 1,500 calls a month. To meet this demand and satisfy varied groups of users, Babson has devised a series of service delivery models tailored to each group’s needs.

Many colleges and universities are now migrating to client/server networks and increasingly complex and sophisticated information technology (IT) environments. Some are redesigning business processes and course delivery to operate on the Internet. While each of these efforts no doubt possesses its own unique attributes, they all share some common challenges. In the first place, client/server technologies are extremely difficult and costly to implement and maintain. Their initiation places great strains on the end user trying to adapt and apply these new tools in the classroom, lab, office, or residence hall. The ongoing support of information technologies also places a considerable strain on the institution’s IT team as the complexity of the environment grows and its points of failure multiply. Ultimately, the move to a new IT architecture, be it curriculum- or market-driven, brings with it demands for a greater investment in the human and financial resources required for its development and maintenance.

This situation is further complicated by the media hype concerning the ease of transition to and the major paybacks from the move to a highly decentralized, World Wide Web-based, information-rich work environment. The expectation among the users of these systems is quite high, and their tolerance for network failure or delay is correspondingly low. As the managers of information technology resources, CAUSE members are no doubt sympathetic to the needs and fears of their customers. The question remains, what can be done to address user requirements in a period of rapid change, growing use, greater complexity, and constrained resources?

In the view of the author, any institution’s response to this set of issues must revolve in part around the effective and efficient delivery of support services. These services should address network and information technology product failures, the sundry questions and problems of customers, and the overall enablement of campus business processes. To this end, any successful model will involve the greater community of users working in conjunction with the campus information technology professionals. Together, they will share responsibility for training and problem solving, for managing external third-party service providers, and, in short, for establishing a multi-tiered support strategy in keeping with their needs and limited resources.

This article examines the various potential components of a higher education information technology service and support model and how these pieces are being deployed at Babson College to address particular institutional and user requirements. While the ideas presented here reflect the particular experiences of Babson, they draw upon dozens of other examples from both private and public sector organizations. It is the author’s hope that readers will build upon the following examples in fashioning solutions for their own organizational settings.

The context for IT support services

In 1990, Babson College began its transformation from a modest to an extensive user of information technology, where approximately 70 percent of all work is computer-mediated, and where both administrative services and teaching have their own Web-based components.1 The Babson campus includes some forty-eight
buildings, more than 6,000 network nodes, over 1,500 computer workstations and associated peripherals, and a user community of approximately 4,000. Users have access to Microsoft’s Windows 95 and Office, Lotus Notes, Netscape, various HTML tools, electronic mail, file and print services, the library system, CD-ROM libraries, statistical tools, database tools, online information services, and sundry other College information resources. All of these products are delivered through a now five-year-old client/server network running under Banyan Vines and Microsoft NT. By and large this environment is stable, robust, scaleable, and otherwise unremarkable.

As a community of users, Babson is also somewhat typical. The College’s student population includes 1,700 undergraduates, an equivalent number of full-time and evening graduate students, nearly 200 faculty, and 300 or so administrative employees. Most class work involves the use of information technology by both faculty and students. In addition IT-enabled collaborative teamwork plays an important part in the Babson educational experience. Classrooms are equipped with computer workstations and multimedia, audio/visual projection systems. Increasingly classrooms are wired to the seat so that students may bring their laptop computers to class and plug into the campus network.

When the campus network first became available, usage was modest, educational applications were few, and IT resources appeared to be in balance with user needs. Indeed, the College’s chief information officer spent a great deal of his time marketing network services and the possibilities afforded by emerging information technologies to a largely disinterested audience. However, with the emergence of the World Wide Web as an important teaching/learning tool, these circumstances changed dramatically. The demand for greater capacity—processor speeds, storage, bandwidth, and so forth—as well as for new services began to skyrocket. The College IT team’s ability to deliver services soon began to lag behind user requirements, especially in the area of support.

Two independent trends encouraged these developments. On the one hand, in 1994, Babson adopted a new customer service paradigm and began to reengineer all of its student administrative services. As part of this effort, Babson’s IT team introduced collaborative (Lotus Notes) and workflow management (Action Technologies’ Action Workflow) software into the environment. Concurrently, the College’s reengineering teams began to select and implement new transaction software, including admission, student information, student billing, student advising, financial management, and purchasing systems. On the other hand, the faculty began to turn in increasing numbers to the campus network and the Internet to deliver assignments, to conduct teaching activities, and to pursue professional and research interests. These two clusters of activities—administrative system changes and the greater use of IT in and outside of the classroom—raised a host of service and support problems.

Response time became an immediate issue as the College installed high-end client/server applications, prompting the move to Windows 95 and Pentium-based client machines. The demand for Office 95 followed immediately thereafter. The coordinated installation of these products became an issue, as did the fine-tuning of the network. The associated need for added training, documentation, and expanded help desk services also accompanied these changes.

Similarly, while Babson provided Internet access for all of those on campus, off-campus access emerged as yet another pressing need. Such a service was of particular interest to our faculty and non-resident students who wanted electronic mail, file services, and Web access from their homes, off-campus offices, or from wherever they might be traveling. The intensity and immediacy of this particular set of demands took the College IT team somewhat by surprise. Furthermore, an effective solution to address this requirement proved difficult and time-consuming to design and implement.

Perhaps most importantly, network availability and reliability became (and remain) major service and support issues. As students, faculty, and administrators came to rely more heavily on the College’s IT environment in conducting their daily work, their tolerance for interruptions evaporated even as their expectations for expanded support grew by leaps and bounds. For example, between 1991 and 1996, help desk operations grew from forty to seventy-six hours per week and from a staffing level of two to three full-time-equivalents in response to demand. Many customers now want “24x7” coverage (twenty-four hours a day, seven days a week). Similarly, the weekly network shutdowns from 10:00 p.m. Thursday to 8:00 a.m. Friday for maintenance now proved unacceptable. Steps are being taken to move downtime to Friday evenings/Saturday mornings.

Finally, “availability” from the user’s perspective does not differentiate between the local IT environment and the many interconnecting pieces between that user and College services. It is, therefore, not sufficient that the net-
work “work right” all of the time, but it must also operate in conjunction with external telecommunication networks and Internet service providers (ISPs). These necessary linkages have certainly complicated the lives of the College IT team in meeting customer needs, especially when the users themselves have no sense of the interrelated complexities and uncertainties of an Internet-focused IT environment.

Service/support components
To address emerging IT needs, Babson College established an Information Technology and Services Division (ITSD) in 1990 under the aegis of a chief information officer (CIO). Over the years this organization has evolved in line with the use of IT on campus. During that same period, the financial and human resources devoted to service and support have grown dramatically. The current list of offerings includes:

- help desk and dispatch support
- Technology Specialists program
- Residential Technology Associates program
- dedicated service/support assignments
- IT training courses and online tutorials
- IT documentation

Help desk and dispatch support
The help desk operates Monday through Thursday from 7:30 a.m. to 10 p.m., Friday from 7:30 a.m. to 5:00 p.m., and Sunday from 3:00 to 11:00 p.m. year round. Customers are asked to call the help desk (extension “HELP” ) from on or off campus for any IT-related problem or need. Typical help desk calls include questions about the use of hardware and software, requests for on-site service support and problem solving, and the placement of formal work orders for new/expanded IT products and services. Help desk operators (three during the day and at least one in the evenings and on weekends)—all professionals—triage calls, and whenever possible address the customer’s needs over the phone. The College help desk handles somewhere between 1,000 and 1,500 calls each month, of which 60 to 80 percent can be addressed immediately by a help desk representative.

The majority of these calls concern questions about Microsoft Windows 95 and Office products, campus electronic mail, or remote access services. Internet-related calls are typically forwarded to library Information Services Consultants for handling. A small portion of the remaining help desk traffic is project oriented, generating work orders. These are directed, usually via electronic mail, to the appropriate party responsible for action on the particular request. The help desk serves as a clearinghouse. All work tickets are logged into a Lotus Notes database and tracked until they are closed. Help desk personnel regularly call customers to follow up on open work orders.

The final portion of help desk calls involves the need to dispatch IT personnel to a user location or to the data center to fix a particular problem. These services include everything from the clearing of printer paper jams and the replacement of ink jet cartridges to the rebuilding of client desktops or network server loads. Dispatched support operates Monday through Thursday from 7:30 a.m. to 10 p.m., and on Friday from 7:30 a.m. to 5:00 p.m. A beeper service is in place on all week nights and weekends when the help desk is closed, but this arrangement provides service for emergencies only, such as a full network shutdown or problems that prevent class delivery.

In general, the help desk and dispatching services have met with wide customer acceptance and satisfaction. Emergencies, especially those affecting classroom and student computer lab activities, are addressed as top priorities.

Initially, communication failures did occur between the help desk and dispatch. To remedy this problem, the help desk was reconstituted as a Network Services Support Team that includes the staffs who install cabling, install and service client machines, manage the network, build the servers, and answer the help desk lines. All members of this team work help desk shifts. Increasingly team members are cross-training one another, sharing their expertise. As a result, fewer problems have fallen through the cracks, and overall response time in addressing customer problems has improved.

Nevertheless, the network team model is in and of itself insufficient. In the first place, our customers are demanding more extended hours of coverage than we currently provide. Second, the help desk cannot always handle the volume of calls during peak periods. Third, by its very nature, the help desk is reactive rather than proactive. Fourth, the help desk is expensive and the College cannot afford to continue to grow the service, even if that is what our customers might want. Finally, some College constituencies, including faculty and residential students, need different types of support than those afforded by a help desk design. The question, therefore, became one of how to more effectively leverage the help desk investment to better serve customers without adding to already burdensome operating costs.

Technology Specialists
In brief, Babson has devised a series of tai-
lored responses based upon the characteristics and circumstances of specific user groups. For College administrative units, the IT team established a Technology Specialists program. In conjunction with human resources and the institution’s management team, the CIO identified positions within each operating unit where the job description also included responsibility for local IT support. IT personnel next developed a special training curriculum for those in these positions. The basic rationale behind the program was that the IT team would train employees who would in turn serve as local experts in their respective departments. The concept was generally accepted, and when a computer virus broke out on campus, the Technology Specialists (TechSpecs) proved themselves invaluable in helping IT address the problem.

On the other hand, the program has had its problems. The development and maintenance of the training effort proved more difficult than anticipated and required additional annual funding. Attendance at training by Technology Specialists was sporadic either because the Specialists themselves did not believe that they could afford to take time away from their “real” work or because (as was often the case) their supervisors did not want them spending time on IT training when there was work to do. Even those who attended training and were enthusiastic now find themselves torn between the need to complete their daily work and their new responsibility to help co-workers through their IT problems. The Technology Specialist program nevertheless continues at Babson College with mixed results.

Residential Technology Associates

On the student side of the house, Babson has instituted the Residential Technology Associates program, comparable to the Technology Specialists program. Residential Technology Associates (RTAs) are students employed to work in College residence halls Sunday through Thursday evenings. In effect, they are on call to their fellow students at those times when the help desk is closed. Teams of two students each are assigned to designated buildings. Their phone numbers are listed on bulletin boards in the residence halls, and students call them for help.

To date, the College has invested little in this group other than paying their salaries. Typically, they are highly proficient, self-taught technologists. If they cannot solve a particular student’s problem, the Associates will direct the student to the help desk for assistance during normal business hours or to the College computer store or some other appropriate third party. Students like the service but complain that there are not enough Associates to go around. The Associates themselves admit (as does the IT team) that they need more training to be effective, a shortcoming the College will correct in the coming academic year.

Dedicated support/service assignments

Faculty pose special support challenges. While they use the help desk, they are not inclined to attend IT training sessions or read documentation. Some of these customers employ the help desk as their primary training tool, an application for which it was never intended. At the same time, faculty departments do not have staff that may be assigned to the TechSpecs program. Furthermore, faculty IT needs are often at a more sophisticated level than those of the College’s administrative personnel. This group of users therefore required a different support strategy.

To date, Babson has developed three specific responses to this need, and all have met with great success. In the first instance, the College established the position of faculty IT coordinator, a role that reports to the academic deans. This person is an advocate for faculty IT needs and proactively seeks their input in such areas as classroom design, the selection of audio/visual and instructional technology hardware, the purchase of course software, and the assessment of IT team service delivery. As a technologist who is independent of the College’s IT division, the coordinator serves as a liaison between Babson’s academic programs and its technology support team. Both the faculty and the IT team have benefited from the facilitation and fact gathering conducted by this individual.

In terms of day-to-day support, ITSD also provides a peripatetic help desk staffer who is on call to the faculty and who travels from office to office solving problems and providing focused, personalized training and support. Finally, in the case of our new graduate building with all of its high-tech classrooms and equipment, ITSD has assigned a full-time technologist to support daily operations. Both of these employees carry beepers and are backed up by the help desk and the other members of the Network Support team.

Training and online tutorials

In terms of training programs, the IT team offers from six to twelve sessions each month, typically of one-and-one-half to three hours in length. These sessions are scheduled at night or during the day depending upon the focus audience and take place in one of Babson’s fully equipped computer classrooms. At the end of each month, ITSD posts next month’s schedule...
... the demand by our customers for more and better services has outstripped the institution's capacity for the foreseeable future.

Documentation

The College publishes two lines of documentation products in two different venues. The first of these products, the Computer and Library Survival Guide, is a single volume that serves as a compendium of information about Babson College's IT and library offerings, including basic instruction in the use of Microsoft products and the Internet. The IT team issues the Survival Guide each summer in hard copy. It is sent to new employees and incoming students free of charge and is available to all others at cost through the college bookstore. The team also maintains and continuously updates a Web-based version of the Survival Guide accessed through the College's homepage. To supplement the Guide, the College publishes a series of customized booklets that complement training course offerings, including guides to Windows 95, Access, Excel, PowerPoint, and Word. As with the Survival Guide, these booklets are published on an annual basis in their hard copy versions and are free to course attendees. Their Web versions are updated regularly and made available online.

In summary, the IT team has provided a wide range of support services to the Babson College community. The underlying philosophy behind the design of these services is two-fold. On the one hand, IT support seeks to provide its customers with “one stop shopping” through the help desk for the resolution of IT-related problems. On the other hand, campus technologists seek to facilitate the use of the College's IT capabilities through specifically tailored documentation, training, and support.

At the present time, considerable Babson resources are devoted to these objectives with mixed results. Furthermore, the demand by our customers for more and better services has outstripped the institution's capacity for the foreseeable future.

Drivers for change within the current state

Given the competing demands for the institution's limited resources, one is obliged to raise two questions: First, can Babson afford to continue or even increase its current level of investment in IT support? Second, can the IT team find ways to leverage its existing support resources more effectively, deriving greater benefit out of current funding levels? Clearly, the current model must change. In all likelihood the College, like many of its sister institutions, will need to limit or even curtail some IT services. For its part the IT team must certainly find ways to spend what it has more effectively, perhaps providing its customers with the option of adding to Babson's basic IT support offerings on a pay-as-you-consume basis. The drivers for change within this context include:

- All customer groups are becoming increasingly dependent on complex IT applications.
- The current state of support does not always meet the support requirements of customers in terms of the completeness and timeliness of the response.
- Some customers now want “24x7” coverage.
- Current support is not proactive but reactive.
- Help does come in response to a call, but the service call is not always accompanied by onsite employee training/development to avoid repetitions of the problem.
- Not all customers take advantage of the courses, documentation, and online help, instead relying on the help desk as a much more expensive form of IT training.
- Local support strategies (i.e., the Technology Specialist and Residential Technology Associate programs) lack sufficient resources and/or user buy-in.
- Some customer groups cannot/will not communicate their IT support needs via the help desk and as a result are both highly dissatisfied and underserved.
- The work environment, including the classroom, has become highly computerized and complex, overwhelming many users with the pace of these changes and with the competencies required to work in these new IT-enabled environments.
- There is a shortage of appropriately skilled people to fill vacancies in the IT team's personnel roster.
The design of a new service delivery model

In response to these change drivers, Babson College is initiating a new service and support model. This model combines some of the most successful elements of the current state with some fresh approaches to service delivery. The goal of this new service delivery system is to decentralize field support, to outsource the support of standard software applications, and to retain as centralized high-level, network-wide problem solving.

The envisioned model combines elements of the existing help desk operation with the relocation of technical personnel into user areas, and the provision of some services through external, third-party providers. This approach appears to be superior to the status quo, which would at any rate require additional resources just to maintain the current level of performance. The basic elements of the design are as follows.

Help desk changes

Help desk calls will be triaged through an automated phone attendant. For example, by pressing “one,” the caller is routed to a third-party service that will provide 24x7 support for those types of questions. By pressing “two,” the caller is immediately connected to a help desk dispatcher who will process the caller’s request and possibly dispatch the appropriate support person to the caller’s location. By pressing “three,” the caller is immediately connected with a help desk person who can deal with the caller’s problem.

At the heart of the new service delivery model resides the concept of a peripatetic “help desk” support staff who are assigned to and reside in specific geographical locations at least part of each work week. Their role is to address user needs face to face as dispatched by centralized help desk personnel, but also to “roam the halls” proactively seeking to assist, train, and develop technology users. From our experiences to date, this approach to service delivery is more effective and efficient, meeting with broad, enthusiastic user acceptance.

The help desk itself will retain current operating hours during Fall and Spring semesters, but for the rest of the year, the help desk will operate from 7:30 a.m. to 5:00 p.m. Monday through Friday with no weekend hours of operation. At any time when the help desk is not in operation and an emergency arises, the help desk line will provide a beeper number for on-call services.

The help desk will be staffed by at least one ITSD professional at all times, supplemented by one or more student employees (typically RTAs) as the volume of calls dictates.

Other changes

- The number of Residential Technology Associates will be increased from ten to fifteen students; each RTA will be required to work a four-hour shift on the help desk; additional students will be recruited as needed be.
- IT support personnel will be assigned to particular business process teams and/or geographical parts of the campus and will work out of those locations, proactively identifying and addressing user support needs.
- Typically an IT support services representative will work three to four days in the field and then manage the help desk one day per week, overseeing student workers, but leaving at least part of a day each week for cross-training and staff development.
- Operating units must either develop or hire technologists to serve as the in-house experts for their respective transaction systems and as liaisons between the IT team and the vendors of those systems. For its part, the IT team will support and foster the success of this arrangement through their local presence in the operating areas on a daily basis.
- A weekly issues session will bring the entire support team together for a debriefing of the week’s events, problems, and learned solutions. Overall team development and cross-training will be scheduled for extended periods outside of Fall and Spring classes.

In its entirety, this model should provide more timely, focused, and personalized service in the field as well as informal opportunities for user technology training and development. Even so, it is clearly a compromise solution and will never satisfy all user expectations. For this effort to succeed, the community as a whole must come to recognize that in balance this model gets the institution closer to the desired state.

On the plus side, the new model regularly places IT experts during peak periods of use in classroom buildings and offices across campus. They will be on hand to witness and immediately correct problems. They will also seek out users, gather data on their needs and problems, and bring this intelligence back to the IT team with an aim towards a more proactive stance towards addressing customer requirements. Lastly and most importantly, the envisioned arrangement will afford a greater level of collaboration and resource sharing among all of those key to the use of IT on campus—users, local experts (in the departments), and IT support personnel.

On the minus side, these changes come with a modest cost. The College will incur added expenses as it increases the number of Residen-

---

9 The College will continue to offer online training, online help, class training and documentation at no cost to the College's operating units. It should also be noted that the new Web-based front-end screens and forms of our reengineered processes only come with online support and documentation.
“...no service model will meet its objectives without the recognition by the campus community that they must take responsibility for their own development as knowledge workers.”

Babson College is now in the process of implementing this new support structure across the institution. The model itself has met with broad community support, recognizing both the need for further change and the need to limit the growth of expenditures on IT support. The peripatetic help desk model has met with overwhelming success, allowing more timely and focused support, and just-in-time user training. The discussion about mutual responsibility for campus information technologies continues.
Information Architecture: The Data Warehouse Foundation

by Charles R. Thomas

Colleges and universities are initiating data warehouse projects in order to provide integrated administrative information for planning and reporting purposes, but few institutions are also undertaking the important process of constructing an information architecture that is based on a taxonomy of academic and administrative activities and a detailed data dictionary. This article describes a survey of forty institutions that have active data warehouse projects and outlines the essential steps to constructing an integrated information architecture.

The purpose of this article is to outline some of the technical, organizational, and process requirements essential to the construction of an integrated information architecture, a key prerequisite for implementing a data warehouse. In preparing this article, the author conducted an informal survey of colleges and universities concerning their data warehouse projects. The great diversity of efforts under way at institutions and the rapid progress in this arena make it difficult to present many detailed analyses, but some obvious trends do emerge, and are discussed.

State of the data warehouse

Industry publications regularly state that over 90 percent of medium and large companies already have data warehouse projects in operation. Detailed reports of most of the corporate data warehouse projects indicate that they capture data about production operations from a variety of systems on regular cycles, normalize data on the way into the data warehouse, then provide managers with friendly front-end analytical tools for analysis. Many of these reports minimize the effort required to capture the “meta data,” that is, the data about the data—the definitions, codes, categories, and descriptions of data elements in the operational systems. In most colleges and universities, capturing accurate meta data is a sizable task, followed by the process of coming to agreement on an integrated set of definitions for the data warehouse project.

Before writing this article, the author conducted an informal electronic mail survey of approximately 250 institutions who indicated in the CAUSE Institutional Database that they had

1 Information architecture refers to the specification of the identifiers, codes, names, and abbreviations of the entities (students, faculty, courses, organizational units, etc.) about which data are maintained in an organization’s record systems and the definitions, allowable categories, and coding conventions for the set of data elements used to describe each of these entities. The term also encompasses the identification of the data elements needed by each organizational unit for the conduct of their activities.

a data warehouse project either in progress or planned. About 100 indicated projects in progress, which amounts to less than 25 percent of the 425 institutions in the CAUSE database. While this was not a random, stratified sample, the numbers do indicate that colleges and universities are well behind the power curve on implementing data warehouse projects when compared to companies. It is, of course, entirely possible that the industry figures are inflated, but the conclusion would still be reasonable. Still, 85 of the 100 institutions that indicated active data warehouse projects did respond to the informal survey. In the final analysis, only forty of the institutions responded with detailed information about their data warehouse projects, and the other forty-five said they actually did not have an active project, but were still in the planning stages.

As might be expected, the majority of the institutions surveyed and the majority of those with active data warehouse projects were universities. Table 1 shows a comparison of the distribution by type of institution for those surveyed, those with active data warehouse projects, and the general U.S. higher education institutional population.

Also as might be expected, the detailed descriptions from the forty responding institutions vary widely. Some clear trends do, however, emerge from examining the data warehouse project descriptions provided. These are summarized below.

**Data warehouse definition**

“A Data Warehouse is a subject-oriented, integrated, time-variant, non-volatile collection of data in support of management’s decision-making process.”

Bill Inmon, Industry Expert

The formal definition of a data warehouse leaves a lot of latitude for interpretation, and colleges and universities appear to have taken full advantage of that latitude. Some of the responding institutions provide online access to operational data files and refer to this activity as their data warehouse. Most, however, extract data from the operational systems on some regular cycle, normalize the data, then refresh the data warehouse with that data. Most have recognized the need for longitudinal data and provide multiple time-date stamped sets of data. A few keep only the current snapshot plus a limited amount of historical data online.

**Database tools**

If the general population of colleges and universities is similar to the group responding to the author’s informal survey, institutions are using a limited number of database tools for data warehouse projects. Three database tools accounted for 85 percent of the responses. Some acquired specific tools just for the data warehouse, but most decisions were driven by database tools already in use for other purposes. The two most popular database tools used by the responding institutions were Oracle (50 percent) and Sybase (20 percent), with Microsoft’s SQL Server coming in third with 15 percent, ahead of a variety of other tools. Most of the data warehouses reported are maintained on a separate server designated for that purpose.

**Client tools**

The institutions responding to the survey reported a fairly wide variety of tools either in use or being considered for use in accessing their data warehouse. Unlike the database decision, it appeared that the choice of client tool was more often than not driven by the requirements of the data warehouse rather than by tools already in place for other purposes. At most responding institutions the choice was based on staff and/or committee recommendations after trials. The predominant direction reported was

---

**Table 1: Institutions by type**

<table>
<thead>
<tr>
<th>Institution Type</th>
<th>Distribution of Institutions Surveyed</th>
<th>With Active Data Warehouse Project</th>
<th>Distribution of All U.S. Institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>University</td>
<td>60%</td>
<td>80%</td>
<td>6%</td>
</tr>
<tr>
<td>Four-Year Institution</td>
<td>30%</td>
<td>15%</td>
<td>56%</td>
</tr>
<tr>
<td>Two-Year Institution</td>
<td>10%</td>
<td>5%</td>
<td>38%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

---

3 Normalize is the term used by database administrators to describe the process of translating different data coding structures from disparate operational systems into a “standard” coding structure for the data warehouse.
toward the use of Web tools, with Microsoft desktop tools as a second choice.

Most responding institutions reported support for Windows/Intel and Apple Macintosh desktop computing environments as clients on the institutional network and for the data warehouse. In some cases, this dual client platform support affected the choice of client tools. Web tools were most often mentioned as being in use (20 percent), with MS-Access, MS-Excel, and BrioQuery also being used by 10 percent or more of the respondents.

**Data warehouse contents**

Only a very small number of the responding institutions reported having all of the major institutional data areas available in their data warehouse. Most reported building the institutional data warehouse gradually, starting with either student data, human resources, or finance data, then planning to evolve toward a comprehensive set of data. According to comments from the responding institutions, this incremental approach is most often due to resource constraints. Table 2 summarizes the frequency of the data areas reported in institutional data warehouses.

**Data cycles**

Most responding institutions reported having developed a schedule of data gathering that follows the natural cycle for each major data area. These cycles vary from annual and monthly snapshots to as frequent as every three minutes. In almost all cases, the data cycle and the time and date of the last refresh of the data warehouse are noted for each data area.

**Data definitions**

As a part of the research for this article, the author visited over thirty of the institutional data warehouse Websites for the responding institutions to learn about the state of the data definitions provided to users. The level of meta data, or information provided to the user describing the data in the warehouses, varied from nearly none to barely adequate in all but a few institutions. Many of the data warehouse sites visited on the Web provide some data descriptions, even though a few of these appeared to be mere reproductions of COBOL file definitions. Few of the data warehouse Websites visited included plain language definitions of data elements, and none included text descriptions of the categories within elements. This would indicate that either more attention should be given to meta data, or complete documentation is not available.

**Access**

Many of the responding institutions allowed Web visitors to view the description and documentation of their data warehouse, and a few even include the campus data dictionary showing definitions, codes, and categories. Some provided only the briefest description of their data warehouse project, then required special security clearance even for access to the meta data. Most of the responding institutions control access to information in their data warehouse even within the institution, requiring special “log on” techniques with password protection. Security of data and access to the institutional data warehouse are issues requiring attention at the highest levels of institutional administration. A CAUSE task force on privacy and handling of student information in a networked environment recently released a paper reporting on policy issues in this area.4

**Motivation for the data warehouse**

Industry literature stresses the need for top executive sponsorship for a successful data warehouse project. In spite of these admonitions, all but a few of the institutional efforts appear to be first started in the information technology department without top institutional executive sponsorship. One institutional representative even described the origins of their data warehouse project as “insidious.” Institutions responding to the informal electronic mail survey stated a number of interesting motivations for construction of a data warehouse.

Several institutions mentioned “defense” as a primary motivation for constructing a data warehouse. The data warehouse is seen as a way to meet the increasing demand for both data and information with limited staff resources.

Some data warehouse projects were triggered by the installation of new operational systems that were not capable of delivering all of the traditional reports. Many respondents men-

---

Table 2: Data areas in the warehouse

<table>
<thead>
<tr>
<th>Data Area</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td>80%</td>
</tr>
<tr>
<td>Course</td>
<td>20%</td>
</tr>
<tr>
<td>Facilities</td>
<td>23%</td>
</tr>
<tr>
<td>Finance</td>
<td>64%</td>
</tr>
<tr>
<td>Human Resources</td>
<td>64%</td>
</tr>
<tr>
<td>Alumni</td>
<td>18%</td>
</tr>
<tr>
<td>Other</td>
<td>41%</td>
</tr>
</tbody>
</table>

---

4 See [http://www.cause.org/issues/privacy.html](http://www.cause.org/issues/privacy.html) for resources about privacy policy and issues, as well as information about how to order the CAUSE white paper produced by this task force.
The Colorado Community College and Occupational Education System is the largest postsecondary education system in Colorado. Reaching over 200,000 students yearly, it comprises twelve state system community colleges (including the "virtual" Colorado Electronic Community College), with a thirteenth, Northeastern Junior College, scheduled to join the system in July. The system carries another responsibility for three district community colleges and local secondary vocational schools that connect it with the K-12 sector in many parts of the state.

When the Colorado community college system was combined with occupational education in 1986, the new governing board selected Jerome F. Wartgow as CCCCOES president to blend the two groups into a system. Their vision was for a system of colleges that would be adaptable, responsive to changing technology, and committed to serving local needs. Wartgow had his work cut out: member colleges run a wide gamut in size, sociological environment, and technological sophistication (some sites still have to accommodate significant numbers of rotary dial telephones).

In the ensuing decade, enrollment in the system increased by 74 percent—by far the fastest growing educational system in Colorado. CCCCOES made some projections about space needs, tracking the population bulge coming up through the K-12 system, and realized that Colorado did not have the building capacity to support the growth. As Wartgow said, "We began looking at how we could use technology to deliver courses. On the quality side, we’d made a commitment to try to provide the same level of quality and support to all of our colleges no matter where they were located. If you’re out in Lamar with 800 students, we’d like to provide you the same options that we can provide in Westminster with 8,000 students."

This instructional challenge played into System demands for a high degree of standardization and commonality in other service areas, as well. The first seven or eight years of Wartgow’s tenure was an exercise in diplomatic centralization—establishing a common academic calendar, common tuition, faculty workload, core curriculum with common objectives for key courses, common application form.

Working with Wartgow throughout was Don Williamson, Vice President for Information Technologies, who was building a technology infrastructure capable of supporting extensive communication and widely dispersed information needs with minimal duplication and support. The system that has evolved is an unusual balance of centralized and geographically dispersed, standardized and custom-built.

Creating a common infrastructure

When Williamson started his job ten years ago, “We were challenged to put something together technologically. We had POISE in some places, homegrown software in others. We developed a standard set based on Series Z from Information Associates, and VAXes; we borrowed some money and brought up ten or eleven community colleges in one year. It was unbelievable, but we did it.”

Over the years the standard software set has changed—in the mid ’90s, when SCT bought IA, CCCCOES had just converted to SIS-Plus. Rather than move to another commercial option, they “decided to invest in ourselves,” as Williamson described it. “We expanded our staff and reorganized into a structure that could centrally support administrative functions.”
The software result was a blend of purchased and home-built: they have farmed out financial aid to WolfPack for federal regulations, but done their own telephone registration system, faculty management, grades, in many cases enhancing purchased systems for their own needs. In the central Community College Computer Services (CCCS) office in Denver, staff are running Series Z on an Alpha platform. And they aren’t in a hurry to move away from VMS—always pragmatic, they are looking at client/server for some development, but keep many legacy systems for their stability and security.

According to Customer Service Manager Jeanette Lillard, administrative software is now standardized to the point that almost every school that has its own data center receives an automatic download of upgrades and inserts it into production without human intervention. The development is done in Denver, where the job runs for five to seven days, and on Sunday night it is inserted into production at the other sites. The staff is sensitive to special needs: “We didn’t just take code that was developed here and say ‘you have to use this,’” Lillard says. “We worked hard to accommodate local nuances, to modify the code to support unique features they were used to having. The changes were added in for everyone; other schools could choose not to use it.”

A major network development effort started in 1994, with a move from DECnet to a TCP-IP network with standardized routers and hub products. From the central CCCS office in Denver, staff can view the whole system and alert local staff to problems. As Programming Manager Joe

Education Technology Training Center

Tucked unexpectedly into a 1950s-style one-story yellow brick building in east Denver is the technology gem of the CCCOES, the Education Training Technology Center. The startling interior of this 25,735-square-foot production and training facility, designed by architect Otto Poticha of Oregon, has been recognized for its futuristic energy and use of galvanized steel.

The largest educational production facility in Colorado and one of the most comprehensive multimedia production sites in the U.S., the ETTC is part of the vision of CCCOES President Jerry Wartgow: “If we’re going to make a real change in the educational product, we have to have something to do it with.” When Wartgow learned that Lowry Air Force Base was to go on the military-base closure list in 1992, the CCCOES was first to file a proposal for use of part of the facilities as a public benefit conveyance. They received over 153 acres of land and almost a million square feet of building space, including the Lowry Enlisted Club, whose solid terrazzo ballroom floor now serves the ETTC’s 4,000-square-foot production studio.

The Center is the product of masterful planning, partnerships, and bargain hunting. An empty shell on January 8, 1997, open for a full dress rehearsal on February 8, it contains over 115,000 connections and 200 miles of cable linking multimedia production workstations, an executive videoconference center, control room audio suites and a graphic/animation suite, a smart classroom for multimedia training and videoconferencing. Don Ina, Director of Operations for ETTC as of July 1, describes the facility as unique in that all signals are digital, all can be routed anywhere in the building without videotape or “sneaker net,” and multimedia is fully integrated with all classroom development. Technology was selected for seamless integration, simplicity, and upgradability. Williamson estimates that he paid about $4 million for equipment worth $7 million. Major partners are Jones International, U S West, and PictureTel.

According to Executive Director Mary Beth Susman, the Center embodies a basic CCCOES philosophy of minimizing duplication: individual campuses will have instructional technology pods, but this is the facility that will be kept state-of-the-art, allowing faculty to experiment and decide what seems important to carry back home. The vision is that each of the 800 faculty in the CCCOES and a majority of its part-time instructors will cycle through in the next two years, to learn how to take advantage of available instructional technologies.

In addition to training, development of course content in multimedia form is a current priority. Susman is working with faculty experts from CCCOES colleges and industry partners to create Internet and CD-ROM courseware. One such project involves a partnership with a major publisher to create multimedia courseware based on their popular textbooks. The project will use ETTC facilities and system faculty as subject matter experts along with a national advisory committee.
Impacts everybody. That's why we developed the Project Implementation Teams. We have two PITs going now: a Web kiosk project, and our executive information system based on Magic—our first deployment of a client/server application.

The staff forms SWAT-type teams as needed. Denver-based Network Manager Rick Dobbs has been working with a group drawn from as far away as Pueblo and La Junta to bring Northeastern Junior College in Sterling into the system by July 1, the start of a new fiscal year. They have had less than three months to convert the school, with a student FTE of about 1,700, from a PC and old PDP system to Series Z, converting the network to IP.

To coordinate all staff in spite of their geographic separation, the group relies heavily on the CCCOES compressed video/audio network, which has the capability to link up to forty-four sites across its 16-port bridge. This network gets steady use, with an average of eighty hours per month for meetings among Board members, campus presidents and vice presidents, and managers, and at least 100 hours per month of course delivery. The CCCS management team meets for a couple of hours a week via the video network, and individual teams schedule it as needed.

Planning

Driving the teams’ priorities are the user committees for major functional areas—registrars, controllers, financial aid directors, student services, admissions, business officers— with representatives from the various schools. These groups, which usually meet monthly, set priorities for what needs to be done.

At an operational planning level is the Information Technology Executive Committee consisting of individuals from each campus, which meets every two months. To promote communication at the highest level of the campuses, all members must report to a president, providing the data center a first-hand view of what’s going on with the presidents and how they’re reacting to computing services. The first item on every agenda is campus issues.

Systemwide strategic issues are addressed by a seven-person Information Technology Master Planning Council representing major constituencies. In keeping with an overall emphasis on effectiveness...
and frugality, Williamson says, strategic planning for the System emphasizes careful, methodical thinking and communication with minimal documentation. “One of the members of my master planning team, a national consultant on planning, looked at all the pages and graphics I’d compiled and said, ‘How many people do you think are going to read this?’ and then, ‘How long do you think this is going to be current?’ We finally settled on a process: to have a one- or two-page product. No one will read any more than that. So that’s what we’ve done for the last five years.”

**Administrative support**

The primary focus of the CCCS is administrative technology, for which the central office essentially provides all logistical and planning support: development of administrative applications, online ordering, contracting for maintenance, backup of data from the local sites.

“We’ve really worked on trying to run this operation under a business model,” Williamson says. “We look for ways to enter into System-wide agreements that take advantage of our common hardware and software standards to provide the best benefit for individual colleges.” Such arrangements include a MOLP license for the Microsoft Office suite, a maintenance agreement with Digital Equipment Corporation that has saved the system a couple of hundred thousand dollars over individual agreements, and a common contract with Wolfpack. The standardization extends to many office products and forms: CCCS staff create base templates of such necessities as registration forms which can be ordered in quantity and customized for needs of the individual schools.

CCCS works hard to be responsive to user needs. Every campus, even if it doesn’t have its own computing center, has at least one internal information services staff member on site, with some responsibility for campus local networks and instructional technology support, who can take many of the first-line calls for help. To avoid the problem of letting employees at campuses which have on-site data centers get undue advantage from the proximity, Williamson’s group has built a centralized request process. If, for example, the Student Services staff at Pueblo Community College have a request, they electronically submit it to Marguerite Hudak in Denver. She may assign that student project to a programmer in Pueblo or to someone in Denver, depending on their workload.

One of the most popular support innovations in the past three years was the implementation of a central help desk staffed by Ed Hansen, “Mr. Ed.” His 800 phone number is in heavy use, and if he is unable to talk the user through the problem, he knows which CCCS expert to refer them to. When he identifies patterns of problems, either with particular systems or with individuals who obviously need more extended help, he works with Training Manager Dan Tacker to develop an appropriate training program.

To keep users up to date on hardware and software, Tacker and his assistant have designed a complex of on- and off-site training, depending on the need. They balance group programs in their Denver offices with “road shows” to campuses undergoing special implementations, with a heavy emphasis on one-on-one training. They might choose to pull in a programmer who is expert in a new system and ask that person to provide content expertise under their pedagogical supervision. They develop relationships with suppliers, too, setting up, for instance, a training day with a Cisco representative and CCCOES network users. A relatively new area of interest, Tacker reports, is human resources training on stress, working with multiple priorities, or a help desk training session on dealing with difficult customers.

**Instructional innovation**

Support for instructional technologies has been more ad hoc. While CCCS provides the data and audio/video networks to all campuses, and help with RFPs, they essentially provide back-up instructional computing support according to the level of interest of the campus. However, the momentum is building for a major increase in this activity with the growth of the new Education Technology Training Center in Denver whose primary goal is to foster technology innovation in instruction throughout the System (see box page 35).

There is a new emphasis in the CCCOES on distance education, which has been available in a limited way for years but is taking increasing advantage of the System’s PictureTel video network. President Wartgow sees two significant breakthroughs contributing to the new focus: "One was getting the legislature to create Colorado Electronic Community College under a state statute. It’s a whole new college that has the same status legally as any other college and university in Colorado [and is expected to be accredited next year]. That was very, very significant. The second one was convincing the Capital Development Committee to change their definition of capital construction. Before it was based on bricks and mortar—price and life expectancy. We had to do a lot of groundwork to convince them that if they’d change the definition we could reduce the size of our 100,000 square-foot building to 50,000 square feet and put the rest of the money into technology. We did that. The breakthrough was that the technology support no longer had to come out of the operating side of the house.”

Providing library support for this diverse assortment of institutions has been difficult. While all member colleges have libraries, some of them serve primarily off-campus, distance-learner students. CCCOES focuses on guiding users to tools such as CARL and CD resources. These efforts often tie into community service projects, which are a priority for the System. CCCOES is a leader in the Connect Colorado (C2) group which links higher education and K-12, state agencies, libraries, and hospitals to better serve rural areas. A pilot project of the group is working on bringing Internet connectivity into the Arkansas Valley in southwestern Colorado. In urban Westminster, the CCCOES has been consulting with the city to link a community college with the Westminster library, bridging two very different systems with a T-1 line and two user-friendly front-ends developed by the CCCS.

**Can-do creativity**

With state funding allocated by student FTE, and community colleges at the lowest allocation level for state higher education systems, many of the technological accomplishments of the CCCOES have been achieved through creative partnerships, careful deployment of resources, and clear purpose. Williamson points to pressures by business and industry, who both push for outcomes and provide advisory groups to identify means, and to beneficial collaborations with other higher education institutions for needed resources. But the remarkable successes of this group are also attributable to a staff who takes pride in responding to the needs of their customers and working together to solve problems.
Information Architecture
(continued from page 33)

mentioned data integration as a primary motivation; the data warehouse provides a way to normalize data for administrative access without major disruptions to diverse legacy operational systems that are doing the job for an administrative department.

Security is another motivation; the legacy system is protected from hackers by its inaccessibility, and data are made available through a “copy” in the data warehouse. The author has labeled this level of security the Principle of Least Regret—“We will regret it a lot less if someone sees something they should not, than if the master file is blown away.”

Some respondents describe a “mission creep” approach to their data warehouse project. They plan to start small, make some information available to executives, then leverage the availability of that information to acquire resources to make more available.

Benefits of the data warehouse

Many institutions, as well as many companies, see no immediate direct financial savings resulting from their data warehouse project; however, they anticipate important benefits, including:

• The ability to stabilize or reduce mainframe processing by transferring many requests for reports or information access to the data warehouse servers.
• A future reduction in administrative information technology personnel efforts by providing major administrative departments the capability to develop and run many ad hoc reports and queries. (English language descriptions of data, codes, and categories provided through the meta data of the data warehouse will make it possible for administrators to retrieve and utilize data without requiring the time of computer programmers.)
• A way to provide increased and quicker access to administrative data without disturbing legacy systems.
• An easier way to provide administrative data to the entire community over the campus network through the use of graphical user interfaces available on the user’s desktop computer.

It is also beneficial that data in the warehouse are “time-date” stamped, so users will not have to be as familiar with the production schedules of the operational data systems, and data will be accessible on a “24x7” (twenty-four hours a day, seven days a week) basis instead of only during traditional business hours.

State of the architecture

Information systems are an important competitive resource for most corporations, so most maintain them as close as possible to the current technological state of the art. Because of limited resources, many colleges and universities have, on the other hand, been limping along with much older information technology to support administrative operations. The administrative information systems in many colleges and universities have grown out of the technologies of the ‘60s, so it is not surprising to discover that many institutions do not have an integrated information architecture.

Many of the administrative applications evolved from the relatively simple automation of clerical tasks, office by office. The systems were designed to support specific office functions in such locations as the registrar’s office, the accounting office, the alumni office, etc., and few individuals outside of those offices were required to know either the structure or the definitions of the data. Requests for information from top administrators were typically satisfied by those functional offices, and integrated information was usually just not available. Some institutional executives have referred to their campus as a collection of “data fiefdoms,” and it was very important to know which questions to ask of which operational office any time information was needed.

Increased federal, state, and other agency reporting requirements have forced institutions to continuously augment already decrepit information systems until some have been “maintained” to the point of near collapse. Informally, many chief information officers will admit that as much as 85 percent of their technical talent is occupied with maintaining legacy systems, leaving few resources for attention to tasks like documentation and information architecture. Some institutions have installed new proprietary software to solve operational problems, but have not addressed the fundamental information architecture issues. Some executives have mistakenly thought that proprietary software would provide the information architecture for their institution.

The economics of information systems in colleges and universities are also quite different from the corporate environment. A university will typically have over 150 major administrative application systems, each processing a relatively small number of transactions per year. The accounting system in a major university might pro-
cess one or two million transactions in a year. The registrar in an institution with 25,000 students might record six course registrations per student for each of three terms, which would amount to fewer than 500,000 transactions in one year. A major corporation will have far fewer systems, and will number transactions in the billions per year. For example, the peak processing volume of United Airlines Apollo system is 17,500 transactions per second, which translates to over a billion transactions in one day. The significant differences between corporate and academic information systems are best described in Table 3.

The juxtaposition of the number of systems and the number of transactions between corporations and academic institutions has created a very different set of information economics over the years. These differences, when combined with the significant differences in both mission and management style between corporations and higher education institutions, have resulted in a less than integrated institutional information architecture at most colleges and universities. The same comparison illustrates the difference in complexity of data warehouse projects between the corporate and academic environments.

Building an integrated information architecture

An institutional information architecture should include a comprehensive taxonomy of academic and administrative activities and a complete data dictionary with detailed descriptions of all of the information stored in all administrative systems. While every organization has an implicit information architecture, only at a few institutions is it both integrated and explicit. Such a resource can provide valuable information about the campus and the way it operates for both new and existing administrators. Many institutions are well on the way to an institutional intranet as a way to improve communication about administrative matters, and an explicit information architecture is a perfect candidate for that publication medium.

Taxonomy of administrative activities

At the root of an integrated information architecture for any specific college or university should be a comprehensive inventory of all administrative activities on the campus. The most accurate list of academic and administrative departments on any campus is usually the chart of accounts in the business office, but this document seldom provides more than a fiscal picture of the organizational unit. In fact, in the ’70s, when the National Center for Higher Education Management Systems (NCHEMS, http://www.nchems.com/) was developing a standard Program Classification Structure,5 the analysts started with institutional charts of accounts, but soon discovered that the institutional telephone directory contained a more complete listing of all of the academic and administrative organizations on each campus. Some campus organizations do not use the institution’s fiscal system, but few operate without a telephone or a network connection.

A series of campus focus group meetings should be held to develop the institution’s local taxonomy of academic and administrative activities. These meetings can be coordinated either by an outside consultant or with an internal facilitator serving as a catalyst, but some individual should be responsible for producing draft copies of the developing taxonomy. The important point is that each institutional information architecture should include an explicit inventory of all of the organizational units with the local organizational unit identifier and a brief description of the unit’s activities. In the process of constructing an institutional taxonomy, most institutions generally discover that several units are performing the same activities. Of course, activities that should be performed, but are not, are also sometimes discovered in the process. Administrative discussions can then focus on which organizational unit should be responsible for which activities. It may be appropriate for more than one organizational unit to be responsible for a specific administrative activity, but that should be by design and properly coordinated, rather than by default living with uncoordinated duplicative efforts that inevitably produce different results.

The resulting taxonomy will be a major reference in data dictionary activities described below. Each data element description will include references to the administrative units using that element, and the cross references from this source will provide a list of all of the data elements used by each administrative unit. When changes to data definitions, codes, categories,

<table>
<thead>
<tr>
<th>Table 3: Corporate versus academic information systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Systems</td>
</tr>
<tr>
<td>Transactions</td>
</tr>
<tr>
<td>Mission</td>
</tr>
<tr>
<td>Management Style</td>
</tr>
</tbody>
</table>

or descriptions are anticipated, this cross-reference list will provide the means to determine which organizational units will be affected by the change. The institutional taxonomy should be a dynamic document, maintained by a non-parochial office, and accessible to the appropriate individuals on the campus intranet. It is particularly valuable to new executives for learning about the campus organizational structure and administrative activities.6

Data dictionary
The administrative systems in colleges and universities have always involved data elements with definitions, codes, categories, and descriptions. In most cases these data elements were always known by someone, and in some cases even documented. The problem has always been the form and location of this documentation or the identification of the person who knew the definitions. In any major operational office, like the registrar's office, some individual is usually completely familiar with all of the data elements maintained by that office. Sometimes this information is even available in printed form, but seldom is it widely available to other offices.

Over the years, institutional administrative systems were developed sequentially, and usually independently. As a result, different administrative systems might have entirely different sets of descriptions and codes for the same data element describing the same entity on the campus. As a part of any Information Technology Review, NCHEMS consultants typically ask administrators if their campus maintains a data dictionary. The answer is invariably yes, but when a copy is requested, the administrator usually refers the consultant to the computing center. Later the data dictionary typically turns out to be a COBOL file definition in a source program listing, somewhere in the computing center files.

In years past, the primary, and sometimes only, purpose of most administrative information systems was to support a single operational office. In recent years the amount of data maintained in administrative information systems has increased dramatically, and access to that data has become important to many individuals outside the one operational office. Some of the increase in the number of data elements maintained by colleges and universities is driven by external reporting requirements, and some represents the centralization of “fugitive” data previously maintained on paper by a wide variety of individual offices. To illustrate the dramatic increase in the number of data elements maintained by colleges and universities, the original NCHEMS Data Element Dictionary,7 published in 1971 and updated in 1973, contained approximately 250 data elements in five separate administrative areas. The CHESS Data Definitions for Colleges and Universities, published in 1996, contains definitions for 781 data elements in six separate administrative areas.8

From an organizational perspective, the development of an institutional data dictionary is a daunting task that should involve a wide variety of campus offices. Beyond the operational office with primary responsibility for maintaining data, several other offices must be consulted before the definition, codes, categories, or descriptions of any data element can be changed. Campuses with well-developed data dictionaries usually have an information policy and advisory committee structure for dealing with any changes to their data dictionary. The campus data dictionary is also a handy reference for the many individuals who now have access to the core administrative information systems.

Maintenance of the campus data dictionary should be assigned to a non-parochial organization, which many times is the office of institutional research, analytical studies, planning, or similar administrative department. Unfortunately this task is usually viewed as a technical problem to be assigned to a data administrator within the institution’s information technology unit. In these cases it should be no surprise that the data dictionary addresses the technical aspects of data, and is sometimes less than useful to non-technical administrators. Like the institutional taxonomy of academic and administrative activities, the institutional data dictionary should be a dynamic document, accessible to the appropriate individuals on the campus intranet.

Summary
Higher education institutions may be behind corporations in the development of data warehouses, but the dramatic differences between the two environments require very different approaches. Institutions would be better served by adopting a strategic approach to all administrative information systems, including data warehouses, rather than the incremental approach currently being employed by many colleges and universities. Data warehouse activities may provide some of the anticipated benefits, and they may even prolong the life of some legacy systems in the short term. The more important predecessor activity for most institutions, however, is the campus information architecture. It is key to the integration of data in the operational administrative information systems, and therefore key to the long-term viability of the data warehouse.

(continued on page 60)
Taming the Internet for Electronic Data Interchange via a Secure Server

by David H. Stones

In the fall of 1995, the University of Texas at Austin placed in service a dedicated UNIX machine to provide educational institutions a simple, convenient, secure mechanism for exchanging formatted educational documents—primarily transcripts—via multiple Internet protocols at no cost to the users. This article is intended to showcase an interesting technological project, increase EDI awareness and use of the server described, dissuade others from building their own such servers, and reinforce the concept of Internet security for transcript exchange.

Student information systems staff at the University of Texas at Austin have invested heavily since the early 1980s in local and national efforts on standards for electronic data interchange (EDI).¹ In September of 1994, discussions turned to some obstacles that had arisen with regard to using the Internet for electronic data interchange of student transcripts. A plan of attack was carefully developed, calling for providing a trusted third-party service to those wishing to use the Internet for EDI. The plan was endorsed by the Technology Committee of the Texas Association of Collegiate Registrars and Admissions Officers (TACRAO).

To carry out the plan, the UT Austin registrar’s office purchased a computer, and a team of systems analysts began software development in an unfamiliar arena, utilizing tools that were also new to us. Considerable programming was mixed with integration of existing software and products, which we found to be largely free of charge for nonprofit public institutions. Substantial assistance came from the Internet community and other schools. The national educational EDI group was very interested and supportive of our project.

In less than a year, the UT Austin Internet EDI Server was tested and placed in service. Since then, 140+ institutions have registered with the server, more value has been added, and usage has increased steadily, with no major setbacks. Through cooperative efforts, we were able to integrate many separate pieces to deliver the planned service. Usage of the server is now in the plans or actions of many states, colleges, universities, and school districts. Higher education has pioneered safe and effective EDI of student transcripts on the Internet.

SPEEDE/ExPRESS origins

During the ‘80s, several successful projects for electronic transcript exchange were implemented. These were confined to states or communities, and they used different proprietary formats. Beginning in 1988, the American Association of Collegiate Registrars and Admissions Officers (AACRAO) and the National Center for Educational Statistics (NCES) sponsored an effort to derive a single national format for electronic transcript exchange. The college format (SPEEDE, for Standardization of Postsecondary Education Electronic Data Exchange) and the pre-K-12 format (ExPRESS, for EXchanging Permanent Records Electronically for Students and Schools) share a common format which has been approved through the American National Standards Institute as an ANSI ASC X12 standard for EDI (namely Transaction Set 130, or TS130).

Developers were primarily from the U.S., but Canadian participation in the development group made the format more robust. TS130 provides codes and structures allowing schools to carry whatever personal and academic items they choose to include on their transcripts, or to send similar information as part of an electronic permanent record upon movement or transfer of a student to a different school or school district. Transaction sets have also been approved for other formats associated with the delivery of transcripts, as well as representing the information in the application for admission, course inventory, and verification of enrollment. Work continues on other educational data standards.

SPEEDE/ExPRESS advantages

Use of EDI for transcripts has important advantages. Recipient institutions have tremendous

¹ Electronic data interchange enables computers of different types to send and receive information directly between organizations that have established a trading partner relationship.
opportunities to automate or reengineer their processes and save considerable resources. Electronic transcripts may be instantly logged into the prospective student systems, allowing admissions staff to inform applicants that transcripts have been received, an event that can take weeks for paper documents arriving in the mail at the application deadline. GPA calculations and evaluation of transfer courses into the receiving institution’s course numbering system can be accomplished programmatically with no required data entry, potentially eliminating hundreds of hours of repetitive manual work.

The sending institution can realize financial savings by eliminating the paper, stuffing, and postage costs associated with delivering paper mail. End-of-semester peak processing is also moved from a manual to an automated process, reducing the load during peak periods. The greatest benefit to the sender is in providing better service to the student, enabling information to be quickly delivered to and processed by the recipient.

With so much to be gained through the use of EDI, one would expect rapid acceptance and deployment of this new approach for exchanging transcripts. However, while the number of institutions exchanging EDI transcripts or working toward that result has been very gratifying, the movement has been neither pervasive nor fast.

Why is this the case? For schools with complete student records stored in computer databases, there are three steps for sending transcripts electronically: extraction of data from their files, translation into the ANSI X12 format, and delivery of the file. The wide range of options and difficulties associated with the actual delivery process has been a major impediment to the widespread use of EDI in higher education.

Delivery options: VANs vs. Internet

Early state-oriented electronic transcript exchanges employed value-added networks (VANs)—although sometimes indirectly, as the backbones for state networks—for delivery of transcripts. These worked reasonably well but with significant cost per transcript.

At the first annual SPEEDE conference in 1990, representatives of several institutions urged the harnessing of BITNET for delivery of transcripts, despite doubts by the standard developers and promoters. Several institutions later conducted limited Internet pilots and were quite encouraged by the results.

Wide-open Internet usage continued to be distrusted on the basis of operational, dependability, and security concerns. The existence of many different flavors and protocols on the Internet was also confusing. Still, the number of institutions already connected and using the Internet for other purposes was increasing steadily, and familiarity and financial objectives kept the desire for EDI on the Internet high. It was assumed that industry would soon present a satisfactory Internet solution.

In 1993, in an effort to better understand the issues, the SPEEDE Committee and ExPRESS Technical Advisory Group met with representatives of the Internet and the Internet Engineering Task Force. The IETF is the structure that approves proposals for Internet protocols and through which requests for comment are followed by formation of discussion groups, consensus agreement on standards, and testing of the standards. This encounter was very informative, and the IETF accepted the charge of addressing EDI over the Internet.

Basically, both of the primary Internet protocols, file transfer protocol (FTP) and electronic mail with MIME, are workable for EDI from an operations standpoint. Both, however, have scalability problems, and both have dedicated followers who are not about to discard them to switch to the other protocol.

The issues of Internet security and privacy are also very important. Encryption offered promise, but management of encryption keys for thousands of schools at each of thousands of locations remained a dilemma. These issues are discussed in greater detail below.

Disadvantages of VANs

While VANs have been effective for EDI, at least four problems made us look for a viable Internet solution.

First, delivery via VAN was costing around one dollar per transcript, based on Texas Electronic Transcript Network (TXETN) experience. While recipients considered it “worth it,” there was interest in avoiding this cost. For high schools and school districts, solutions with incremental costs were unattractive.

Second, there are many VANs, and both exchange of documents and access to management information about them are far easier if all trading partners are on the same VAN. Which one should we select?

Third, scalability is a real problem. Establishing trading partner relationships with the VAN provider for each pair of the tens of thousands of schools was a frightening thought, with close to an n-squared number of relationships for n institutions. The problem increased in the case of different VANs, where interconnect agreements had to be set up on both VANs.
Finally, states and schools had already spent millions on Internet functionality and connectivity. Using it to save money would be highly desirable.

Disadvantages of Internet

Even with the Internet, we had a problem similar to that of multiple VANs; namely, sender and recipient could not make independent selections. A school electing to deliver via FTP might be unable to exchange with a school that had built systems based on MIME attachments to e-mail. Those supporting encryption could not deal effectively with those wishing no part of it. How could we support all options, yet allow schools to make selections based only on the best fit with their own computer environments?

Scalability remained an issue with Internet delivery, as well. The notion of hundreds or thousands of schools logging in at least daily to each of hundreds of other systems to drop off or obtain files was unacceptable, so a single delivery by each school would be an objective. Distribution of passwords in an n-squared pattern compromises the secrecy of the passwords—how is scalability solved?

Finally, trading partner relationships needed improvement. The need for advance set-up for every possible combination was too expensive. We needed a system in which each party could register centrally, then rely on the central registry for information on potential partners.

Needed: A simple Internet solution

With all the available options, nobody felt qualified to make the selections with any degree of confidence. Many registrars willing to participate were asking for ABC instructions on what they needed to do, a difficult task in the absence of a single acceptable delivery vehicle.

The system had to be easy to use, without requiring training in new protocols. The delivery process needed to be at least as simple as with VANs. Simplicity engenders trust, while complexity makes defense of the security of our solution much more difficult for the lay person. A simple alternative to the delivery dilemma would allow institutions to concentrate their resources on the task of producing ANSI ASC X12-compliant files, rather than worrying about how they are going to deliver them.

With news of Internet break-ins commonplace, security had to be ironclad. Authenticity of documents had to be assured. Trust had to exist that documents had not been modified in transit. Students must be assured that their documents have had their confidentiality maintained, as required by both the Family Educational Rights and Privacy Act (FERPA) and general good information practice.

Description and function of the UT server

The server itself is a DEC UNIX machine, dedicated to use as the UT Internet EDI Server. Externally obtained software is used to handle

---

Capabilities of the UT Austin Server

- Supports both FTP and MIME attachments, so institutions are not forced to choose a protocol less attractive to them.
- Allows sender and recipient modes to be different.
- Allows one easy delivery in either mode.
- Generates supporting messages, such as problem notification via system-generated e-mail.
- Supports digest mode feature of temporary storage, holding all files until a specific time (every day) before delivery.
- Supports “send immediately” override ability.
- Produces status and activity reports.
- Supports a temporary hold on delivery (rather than rejection) while (unregistered) recipient information can be obtained and added to the internal table.
- Supports encryption for privacy and added authentication.
- Allows both registration and encryption to take place between just the institution and the server, without regard to other trading partners.
- Simplifies the delivery process.
- Eliminates delivery expenses.
- Allows easy connection to hundreds of schools.

“How could we support all options, yet allow schools to make their selections based only on the best fit with their own computer environments?”
"The server runs with no conscience, and it will not generally attempt to impose morals on those who use it."

Internet e-mail, FTP for file transmission, and PGP (Pretty Good Privacy) encryption. Internal operations are handled via software written in Perl.

The server has few components. A file contains identifiers and delivery parameters for those institutions registered with (and thus capable of doing business with) the server. Another part is the software itself, which for all practical purposes runs continuously. Four components can be thought of as I/O ports: for incoming e-mail, files coming in via FTP, outgoing e-mail, and files going out via FTP. Add the communication and notification function, and the picture is complete.

The only input accepted by the server is files, and these must come via either MIME attachments to Internet e-mail or as file drop-offs via Internet FTP into an area dedicated for use by that institution. These files must be ANSI ASC X12 compliant, which means they must conform to the data standards with a standardized envelope for delivery instructions.

The file delivered to the UT server may contain one or more envelopes, intended for multiple recipients and including different types of documents. The file is always delivered by the sender to the address of the server, which takes over from there. Regardless of whether e-mail attachment or FTP is used, the file may be encrypted using the PGP encryption algorithm. This is done using the public key of the server, and may also include the digital signature of the sender.

The first processing step is recognition of receipt of a file. Second, the file is unencrypted (if encrypted) using the private key of the server and the public key of the sending institution. Third, the file is parsed into envelopes intended for different destinations. Fourth, the registrant table is checked for presence of an entry for the codes identifying the sender and the recipient. Failure here generates messages to the server administrators and the sender, but kills subsequent processing. Fifth, the envelopes are encrypted and delivered according to the delivery parameters selected by the recipient. Finally, notification e-mail messages are sent to administrative officials of both the sending and the receiving institutions, notifying them of the nature of the file received, the success in delivering it, and/or the need to pick it up or process it. The delivery protocol and parameters may be changed by a school with no effect on trading partners.

The server runs with no conscience, and it will not generally attempt to impose morals on those who use it. Aside from asking for compliance with ANSI ASC X12 standards, it will not get involved in the question: What should actually be sent within the (fairly permissive and flexible) framework of the standard? We anticipate only limited syntax checking. We have a few constraints, such as MIME or FTP, but only to render the system secure and our task as simple as possible; simplifying assumptions are the only kind to have. Rules of usage are included in a Frequently Asked Questions (FAQ) document.

Security

From the beginning, the developers of the data standards for educational EDI knew they needed to plan for delivery standards more "open" than those used in the business community and on VANs. With tens of thousands of potential trading partners, we would have to use networks and protocols provided by their states or provinces. Because of this, the initial development of the TS130 format for the educational transcript was accompanied by the TS131 for acknowledgment of an individual transcript. The purpose was to provide both authentication of the sender (a guard against transcript mills, which are a problem with paper documents) and evidence that the document was not modified en route.

Here's how it works. For every transcript received, the recipient produces a TS131 acknowledgment and sends it back to the certified acknowledgment address of the institution identified as the sender within the transcript. The acknowledgment includes identification of the student, plus a few computed values (total classes and degrees) and an academic summary with academic grade points. The recipient of the acknowledgment reconciles it with his file of transcripts sent. He notifies the TS131 sender in the event of his not having sent the initial TS130 or if his totals differ from those in the TS131. It has the added benefit of providing quality assurance unknown with paper transcripts, as one has a record of receipt, and can follow up on transcripts which are not promptly acknowledged. This is part of the SPEEDE/Express protocol, and has nothing to do with the UT server, except that the TS131 is easy to return to the sender via the server, and the authentication and modification threats are already covered.

The Internet break-ins were not much cause for alarm, unless a villain were to break into a site, assume an identity, learn all the right passwords and protocols, manufacture an evil student record, produce a flat file, translate it into TS130 format, and send it to a destination where it would benefit the student of record—an unlikely scenario. The area not covered for the open Internet was that of privacy. What could protect
the file against unauthorized viewing—casual or malicious—as it passed through the airwaves or waited at a gateway?

While public carriers assume responsibility for privacy within their own domains, there appears to be no such liability at points where regional Internets connect to one another. FERPA requires that registrars take reasonable measures to ensure the confidentiality of student academic records, so some action was needed.

Our solution is PGP encryption. It guarantees privacy from all except those with the necessary private keys, meeting both the spirit and the letter of the law. It is also available at no charge for public and nonprofit institutions. Versions are available for many platforms, including DOS, Windows, Macintosh, and UNIX, although not yet for MVS mainframes. An added benefit comes via the signature function of PGP, because it adds a separate authentication assurance, as only the institution with the proper private key could have signed the document. The signature also includes a derived number which signals modification.

Thus, we are protected by multiple layers of security in the area of authentication. Even if one layer fails (or is eventually compromised), we are still protected. By use of PGP, we also extend the privacy and modification protection beyond the actual Internet transmission phase, and cover from the time the file is encrypted at one end until it is processed at the other. This is important because exposure of such files is far greater at either end than it ever is during transmission.

The server has other security features worthy of note. Log-ons to the UNIX box are strictly limited, as it is not used for other activities. FTP log-ons are password protected, limited to specific directories, and denied all except “write” capability. Each institution has a pre-established relationship with the server and is a known entity, adding yet another layer to the authenticity assurance. Functional acknowledgment of the entire file, or notification similar to TS997, is possible. E-mail notices about files received or sent make it difficult for a single suspicious party to avoid detection at a participating institution. The system logs activities, and it notifies server-support analysts of invalid log-on attempts. Exposure is limited by the fact that the server is used for nothing else, so no other development activity is allowed.

While many were interested in using the server, as hoped, some were skeptical of committing to that course without contractual assurances that UT Austin would continue to operate the server indefinitely with no administrative charge. The capacity of the UNIX box has not been taxed to date, but we could understand the concern. Substantial relief has been provided by the University System of Georgia, which has signed a contract with UT Austin to establish and maintain a hot backup site. This will protect users in the event of a natural disaster in Texas and reassure against the unlikely event that UT Austin might decide to get out of the Internet EDI Server business.

Institutional usage

To be technically able to use the free services of the UT server, an educational institution needs just the following: (1) ability to produce EDI documents consistent with ANSI ASC X12 standards; (2) ability to send and receive files over the Internet via FTP or e-mail with MIME; (3) ability to execute PGP; (4) e-mail for inquiries and notification; and (5) agreement to rules of usage.3

An institution wishing to send or receive via the server must register with the server, providing receipt medium, delivery address and parameters, and notification address. It should persuade intended trading partners to register as well. If using encryption, a copy of the PGP public key is sent to the server via e-mail, and the server’s key is received the same way.

Once registered, the delivery process is fairly simple. The sender prepares ANSI ASC X12-compliant files in the appropriate delivery envelopes and sends them to the waiting ports on the server, after encrypting and signing the files. The sender and recipient are notified by e-mail that the delivery has been made. The recipient then unencrypts and passes the file to acknowledgment, translation, and processing routines.

Approximately 140 entities from twenty-two states had registered with the server by March of 1997, including major EDI software providers wishing to test their products. Maryland, Florida, Texas, and the American Medical College Admissions Service (AMCAS) have been linked. Considerable volume has been seen, especially in Texas and Iowa, and in the feeds to AMCAS. Statewide movements in five states increased server registration and usage. Thousands of deliveries are made each month at no cost.

Especially noteworthy is the use by Austin Independent School District for delivery of high school transcripts to Alamo Community College District, Southern Methodist University, Southwest Texas State University, Texas A&M, UT Dallas, and UT Austin. Richardson and Plano Independent School Districts and the San Antonio Regional Service Center will be using it soon for high school transcript deliveries.

3 Both MIME and PGP may generally be obtained at no cost by educational institutions. For details, see the UT Austin Server FAQ (http://www.utexas.edu/student/giac/speede/index.html).
Early projects in Texas (and Florida) using proprietary formats helped define the national format. The Florida Department of Education will convert and deliver as needed, and Texas schools are now well on their way to switching to the SPEEDE format. The 1996 Texas Performance Review, initiated by the State Comptroller, recommends use of EDI and the UT server.

Consider the University of Miami, a private school excluded from Florida Information Resource Network (FIRN) usage in the earlier Florida project. We (and they) feel that UM can send a transcript to the server, which will send it back to the Miami-Dade Community College address at the Florida Department of Education, which will then send it on to Miami-Dade via FIRN. By taking a free ride of 2,000 miles, the transcript can now travel the two miles to Miami-Dade Community College.

Value-added services

In the initial design, the server was simply to provide a plug-compatible alternative to existing delivery mechanisms. Since it was an ad hoc solution, though, it made sense to tailor it more to the specific business function and usage by colleges. Improvements include:

✓ To the extent possible, non-delivery issues have been or will be addressed, with problems eliminated before they occur. This is an advantage of a dedicated machine.
✓ Additional delivery parameters and the supporting software have been added allowing choices between immediate delivery or holding all files until a prespecified time, as well as delivery to separate addresses to support separation of college transcripts, high school transcripts, and test transmissions.
✓ A new option enforces outward delivery only through encrypted transmissions.
✓ Another enhancement is listing (on the registrant list) of an institution as **test only***, hoping to prevent institutions from sending production transcripts to schools unable to process them.
✓ Another set of enhancements dealt with file formatting, and more specifically with both the platform-dependent protocols for end of line and the choice of variable or fixed-length records on received files.
✓ An invisible enhancement was the physical movement of the server from the basement of the registrar’s office to UT Austin’s Network Operations Center, where traffic is less subject to potential interruptions on UT’s campus network. This also places the server in a better location for detection of problems, and for quick transfer to another local machine.

Changes under consideration (which have not yet been scheduled on a firm timeline) include purchase of a separate development and testing machine, with only compiled production code running on the production server, and consideration in time of a possible rewrite in C++ or some such language if more efficiency is needed. Full routine transfer of operational files necessary to support the backup offered by the University System of Georgia will be on a more regular basis soon. Better management reports on usage of the server are evolving over time. We could use better automated processing of email deliveries returned by mail systems, although most schools elect to use FTP. The system structure supports possible eventual transfer of server registration and testing to AACRAO or some other entity.

Final thoughts

The UT Austin Internet EDI Server experiment to provide a safe and simple alternative for doing EDI on the Internet has become a satisfactory production service. We are glad to have embarked on this project, and we see it persisting. We were most impressed by and are grateful for the cooperation of individuals associated with EDI, education, and the Internet.

We did not anticipate the need for value-added services, but they make good sense now.
They underscore the fact that the business case is more important than the technical details of EDI in developing a successful exchange between institutions. If the right people become involved in planning, implementing, and testing, the technical aspects are manageable.

We learned that while outward deliveries via Internet e-mail are quickly executed, they lack the confirmation of success offered by FTP. FTP delivery attempts may be repeated at intervals, with certain status information returned to the sender, whereas e-mail failures become known over a longer period of time, and the notification varies with the mail service and postmaster at the institution.

We were interested that several state organizations liked the server model so much that they wanted to build their own just like it. We hope that the backup site in Georgia will diminish this movement, as each additional site increases the complexity of the nationwide (and beyond) network. The hassle of maintaining codes and registrants in additional sites increases exponentially with the number of sites. In some cases, however, such as Florida and Maryland, state servers of a somewhat different nature can add different value for their users, serve as agents for institutions, and deal directly with the UT Austin server.

The distrust of a free service surprised us. Despite some generous offers to share the cost, we decided that the simplest solution would be for The University of Texas at Austin to bear all costs of the server. Savings on VAN charges for the Texas ETN (around $8,000 per year for UT Austin) will quickly offset out-of-pocket expenses. If maintenance of the registrant table were to become a burden, that would be an indication of an increased level of participation in SPEEDE/ExPRESS, which is good. We know that the SPEEDE/ExPRESS project and/or AACRAO will offer assistance if expansion to other transaction sets creates administrative burdens. We have received offers of support from several sources.

There is no charge for the service, partially because that eliminates the burden of financial contracts and paperwork, and partially because charging might restrict our freedom to add enhancements and make other changes deemed necessary. UT Austin wishes to simplify procedures and eliminate transmission costs in hopes of helping more institutions to join the SPEEDE/ExPRESS movement, thus increasing the number of documents it is able to receive electronically.

For further reading

Author acknowledgments
This project would not have been successful without the willing participation and assistance of many individuals, and I must attempt to recognize some of them. In alphabetical order: AACRAO SPEEDE Committee; Bruce Alexander, University of Washington; Betsy Bainbridge, AACRAO; Bill Bard, UT Austin; Dave Crocker, IETF; LaNell Day, Alamo Community College District; Cindy Dayton, University of Iowa; Rich Everman, University of California Irvine; Barbara Hewitt, Southwest Texas State University; Rick Jennings, Systems & Computer Technology (SCT) Corporation; Jerry McGauhey, UT Health Science Center in Houston; Don Nash, UT Austin; Les Pennington, University of Washington; Ted Pfeifer, UT Austin; Mike Read, AISD and ExPRESS; Bill Ruiz, University of Maryland System; and Tom Scott, University of Wisconsin–Madison.

The lion’s share of the credit should go to my own staff for their invaluable contributions to the project: Cecily Allmon, Lisa Barden, Kay Coonrod, Jean McArthur, Wally Reeves, Shelby Stanfield, and Tom Yu. The executive officers at UT Austin blessed our efforts and allowed us to place the server in production. And, of course, all of this would have been meaningless without the registrations and use by colleges, universities, and school districts.
A Framework for Universal Intranet Access

by William H. Graves

Colleges and universities appear to be converging on the holy grail of universal intranet access with the escalation of investments in campus networks and in connecting personal computers to those networks. But universal access is a complex goal that requires forethought if it is to be managed and sustained. This viewpoint offers an institutional framework for justifying and ensuring (1) convenient and affordable access to a network-connected personal computer by all students, all faculty members, and most non-faculty employees, and (2) an institutionally affordable approach to supporting such universal access. It is arguable that these ends can most readily be achieved by synchronizing the goal of access with a plan to standardize on a few hardware/software configurations. These two goals (stated in the sidebar at right) are justified and discussed in a holistic context in the first three sections of this article. A final section offers suggestions for implementing these goals.

Colleges and universities vary widely in their priorities, philosophies, practices, patterns of funding, and students’ financial and resident status. There accordingly cannot be one universal access plan to fit all institutions. This viewpoint, then, is meant to provide food for thought to those willing to entertain an aggressive position on universal access designed to contain future support costs at the institutional level. Hundreds of variations and details have been omitted with full knowledge that, in this case, the devil is surely in the details. The advice of this author and his institution—which plans to achieve universal access but has not yet done so—is to commit to getting it right by wrestling with the detail and accounting for all support costs and political traps before proceeding.

Why universal access is a priority

The rationale for universal access is tightly linked to the role of information technology in an institution’s programs, which includes a transformational role in support of the academic mission and the administrative processes serving that mission.

The Universal Access Goal

All students, all faculty members, and most non-faculty employees will have convenient and affordable access to a personal computer connected to the institution’s network at any time and from almost any place they are working or studying—a library, a home, a field location, or another off-campus location.

The Standardization Goal

The institution will contain overall information technology support costs by supporting only a few specific configurations of personal computer hardware and software to be replaced/updated on a technological life-cycle basis.

The academic environment

Students, their parents, and other stakeholders—for example, the legislature in the case of public universities—expect the undergraduate experience to help students learn to use the generic computer and network tools and acquire the associated basic information literacy skills that are so necessary in today’s knowledge-age businesses and professions. Students must have access to and learn to utilize the same digital learning infrastructure that shapes the work environment in today’s profit and nonprofit “learning organizations” that will hire them when they graduate. Specifically, graduates must:

• communicate with individuals and groups using e-mail and discussion-group software;
• locate, evaluate, and retrieve information on the Internet, especially on the World Wide Web;
• analyze such information using appropriate software tools;
• publish the results of such analysis electronically.

To communicate and work with their students and with their colleagues around the globe,
instructors, researchers, and graduate students need these same information-age literacy skills, tools, and Internet access opportunities.

These same skills, tools, and underlying global infrastructure elements enable the institution to extend its learning resources and services beyond the time-and-place boundaries of traditional classrooms, libraries, and laboratories. For example, the institution can use the emerging anytime-anyplace-anypace model of instruction to reach those seeking lifelong educational advantages in the form of continuing professional development or personal growth opportunities. Many alumni, for example, may embrace the possibility of maintaining a lifelong socio-educational link to the institution. These new possibilities contribute to the local, regional, or national economy, meet the needs of non-traditional students, and allow the institution to serve more students with minimal additional investments in bricks and mortar.

In addition, many professors, researchers, and graduate and undergraduate students need network access to specialized technologies and digital resources that support research and professional practice in particular disciplines and professions. These include, for example, specialized databases and specialized software for statistical analysis, textual analysis, computation, and visualization.

The administrative environment

In many profit and nonprofit sectors of the broader external environment in which the institution operates, information technology has enabled the redesign of communication processes, workflow, and many other business processes and practices to the mutual benefit of organizations and their clients or customers. For the institution and its constituencies to reap the same benefits, members of the faculty, staff, student body, and other authorized constituencies must have easy access, as appropriate to their roles and needs, to institutional information and a common set of communication and administrative tools. The institution must streamline or redesign its administrative and information services to the mutual benefit of all of its constituencies and employees by taking advantage of online systems, especially in the areas of student services, financial services, and human resources administration. These might include the student information system, the human resources information system, a common departmental accounting system, and many other planned or extant systems.

The components of universal access

Most institutions have been investing in network infrastructure for the past several years. As this infrastructure achieves critical mass and becomes pervasive, it must be conveniently and affordably accessible to all members of the institution’s community if it is to play a role in improving communication (internal and external), redesigning and streamlining institutional and instructional management processes, and strengthening and extending the reach of instruction, research, and public service.

If one student in a class does not have access to the institution’s network, then the instructor cannot take full advantage of e-mail, a class listserv, a class Web home page, or a Web-based discussion group for the class. Conversely, the instructor must have access to the network if any student in the class is to take advantage of available network services. Similarly, every employee with responsibilities for using an online system, such as a human resources information system, must have online access to the system if the institution is to avoid the duplication costs and confusion of operating both an online system and a paper-based system. These examples illustrate the need for almost every member of the faculty, staff, and student body to have easy access to the institution’s network and its resources. For most students and faculty and many staff members, this access must be available on campus and beyond the campus—any time, any place. The key ingredients of universal access therefore are:

- connections between campus buildings—the fiber network inter-connecting all buildings on the contiguous campus, including any residence halls;
- connections from the campus network to off-campus programs—whether housed in institutionally owned or leased space;
- connections within buildings—wiring infrastructure and network electronics within each institutionally occupied building, including any residence halls;
- mobile connections to the campus network by individuals—from home or when traveling or conducting field work, for example;
- personal and convenient access to a computer—one that is, or easily can be, attached to the network for studying or conducting business.

Why support should be limited to a few configurations

However organized and financed, universal access should be based on support for a limited number of configurations of personal computer hardware and software..."
“Labs will … continue to constitute a critical safety net for providing on-campus network access and other services to students during the class day …”

Computer hardware and software, for these reasons:

- The possible combinations of computer and network hardware, operating systems, network protocols, and basic productivity software in today’s commodity Internet market number in the thousands. Each combination differs from every other in subtle ways that are amplified when they are connected to each other on the network. The proliferation of these systems has placed technical support stiffs in an untenable position. Even the more focused task of configuring and supporting a few combinations of hardware and software for a large client base is daunting. The number of configurations supported by any central information technology organization accordingly must be reduced and kept to a minimum if the institution is to avoid spiraling support costs and optimize the institutional effectiveness of its current support organizations. There will always be a need for special purchases to meet special needs, but these exceptions and the support costs they incur must be minimized in favor of a few standard configurations that can be the focus of both central and distributed support staffs.

- Collaboration (information exchange, backup support, training, etc.) between the central support staff and the support staffs in the departments will increase if most support issues are centered on a few basic configurations.

- Replacement parts and repair loaners can be kept on hand if there are only a few basic configurations to cover.

- Standards are required when personal computers are used for complex computational tasks, critical communication processes, or exchanging electronic information. For example, faculty members can assign specific instructional software to students provided that all of their students have computers that will run the software. Any mission-critical software application, such as a human resources system, which runs only on a specific operating system, provides another example. Moreover, many such mission-critical systems cannot be effectively deployed when they are based on a least-common-denominator hardware/software configuration and require a hardware/software upgrade on a regular basis.

Most members of the faculty and student body and many members of the staff will want to connect to the network from a variety of different locations, both on and off campus. This argues for a focus on supporting laptop computers, but not to the exclusion of a few desktop configurations. It also argues for focusing on systems and applications that rely only on the network protocols of the Internet, since other network standards, such as those proprietary to a particular vendor, are seldom supported by remote-access services.

The continuing role of computer labs and other transient on-campus access facilities

Student seats in most of today’s classrooms lack power and a network connection, a shortcoming that can be addressed only by massive renovations or improved laptop batteries and wireless network connections. This means that, unlike members of the faculty and staff who may have an office with a network connection, students will have to continue to go to a computer lab to connect to the network during the course of their on-campus, class-filled day. This can be inconvenient when time is pressing, as it is, for example, for students checking e-mail or printing their work between class periods. Labs will therefore continue to constitute a critical safety net for providing on-campus network access and other services to students during the class day, even as more and more students own their own computers. Similarly, employees who do not spend their work day in an office will need transient access to the network during their work periods. Institutions accordingly should:

- continue to upgrade current labs, perhaps eventually eliminating general-purpose lab computers in favor of specialized high-end computers, special hardware devices such as

The shortcomings of computer labs

Computer labs cannot provide the convenient access required for students to take full advantage of the network at any time and from any place. For reasons of convenience and safety on most campuses, many students who live off campus prefer not to return to campus in the evening to access the network and its resources. Other students who live in residence halls prefer to work in the privacy of their rooms, and this is possible only if residence halls are wired or make provision for dial-in access. These factors and the unavailability of space on most campuses to accommodate additional labs argue for finding ways to place a laptop computer in the hands of every student. Any such program has to proceed in parallel with related efforts to provide (1) convenient network access points, including computer labs, throughout the contiguous campus for transient use by students, and (2) affordable remote access to the institution’s network.

The continuing role of computer labs and other transient on-campus access facilities

Student seats in most of today’s classrooms lack power and a network connection, a shortcoming that can be addressed only by massive renovations or improved laptop batteries and wireless network connections. This means that, unlike members of the faculty and staff who may have an office with a network connection, students will have to continue to go to a computer lab to connect to the network during the course of their on-campus, class-filled day. This can be inconvenient when time is pressing, as it is, for example, for students checking e-mail or printing their work between class periods. Labs will therefore continue to constitute a critical safety net for providing on-campus network access and other services to students during the class day, even as more and more students own their own computers. Similarly, employees who do not spend their work day in an office will need transient access to the network during their work periods. Institutions accordingly should:

- continue to upgrade current labs, perhaps eventually eliminating general-purpose lab computers in favor of specialized high-end computers, special hardware devices such as
printers and scanners, and network docking facilities for students’ laptops;
• renovate library, student union, or other common spaces to provide network connections for students’ laptops in open study areas;
• investigate the possibility of establishing a loaner pool of laptop computers with wireless network connections for use in open study areas;
• investigate the possibility of creating information kiosks throughout the campus where those without a computer, especially officeless employees, can conduct a brief session on the network.

Off-campus access to the network

An institutionally provided dial-in network service typically has two limitations. It is toll free only in the institution’s local dialing area, and it often cannot scale to provide the quality-of-service guarantee desired by those willing to pay for the near certainty of not getting a busy signal. Institutions therefore should consider working with commercial Internet service providers (ISPs) to ensure that students, along with members of the faculty and staff, can afford to purchase remote access services allowing them to connect to the network at a reasonable cost—a fixed, flat-rate cost to the extent possible—from almost any off-campus location in the world. This is especially important for students who do not live in residence halls and for non-traditional students who do not attend classes on campus. However provided, remote access is certainly a key component of any “virtual university.”

There are a few ISPs with a national or even a global reach and many more with only a local or regional reach. Very few of these, however, currently offer the advantage of providing a connection directly to a campus network, with the consequence that “silly routing” frequently results in slow service. Internet2’s GigaPoPs (gigabit capacity points of presence) may remedy this situation for participating institutions over the next few years. ISPs connecting directly to a GigaPoP will be able to offer the advantage of direct connections to that GigaPoP’s participating institutions’ networks. Even this advantage still leaves the off-campus connection at a disadvantage that goes beyond sheer bandwidth and speed. Many databases, such as MedLine, are licensed on the basis of honoring only those requests for service originating from the licensing institution’s Internet domain. Only advances in authentication technologies and standards and new licensing terms from information vendors will address this deficiency in off-campus access.

First things first: Priority guidelines for affordable universal access

Many institutions today own as many personal computers as they have faculty, staff, and students. These institutionally owned PCs often account for only a fraction of the PCs supported by institutions as more and more freshmen arrive on campus with a personal computer. These trends suggest that the universal access goal might be met without institutional intervention in many cases. But this is a deceptive reading. Many institutionally owned computers are antiquated and capable neither of connecting to a TCP/IP-based network nor of running today’s productivity software. Many student-owned computers do not integrate well into their institutions’ networks, and some students cannot afford to buy a computer.

The latter observation deserves special mention as a guiding principle in considering universal access:

All full-time students should have equal access to a baseline of information technology resources, including convenient and affordable access to a personal computer connected to the campus network at any time and from any place they are studying. In any plan that would have students directly bear some or all of the costs of these baseline services, the institution must be prepared to ensure equality of opportunity for students on financial aid or in tight financial circumstances and must adhere to the principle that access to the institution’s baseline educational resources must be available throughout their studies to all potential students who qualify for admission.

Any universal access plan, whether at a public or private institution, is likely to ask students to bear their fair share of associated costs through tuition or fees. Any plan, therefore, should focus first on utilizing network resources in the instructional program and in mission-critical administrative processes to ensure that the institution’s core instructional mission is served and that students receive a fair return on their investment.

Three suggestions deserve consideration by any institution considering a universal access plan:

✓ Professional development opportunities for the faculty and staff should be a part of any universal access program.
✓ To ensure that priority institutional goals are served and that as many students as possible
are served as fully as possible, institutional investments in faculty, staff, and curriculum development should focus (a) on high-enrollment courses, whole professional curricula, or other strategic areas of the curriculum, and (b) on implementing online mission-critical services in support of these instructional priorities and related student needs.

In phasing in a universal access plan, priority access to leased personal computers should go to (a) instructors teaching in areas of the curriculum selected for strategic institutional investments as suggested above, (b) the student affairs staff, and (c) other employees responsible for providing the online mission-critical services mentioned above.

Universal access suggestions

Purchasing personal computers according to individual preferences and ability to pay, and operating these computers beyond their technological life expectancy may work well for many individuals, but cannot be justified in the presence of the equity issues and attendant escalating institutional support costs cited earlier. At the institutional level, these laissez-faire support costs and opportunity costs would be much higher than the costs of supporting a fleet of hardware and software selected from a limited range of options and retired at the end of its technological life cycle. This is the premise for the suggestions that follow.

Suggestions for standardizing universal access for the faculty and staff

Establish an open-contract operating lease at the institutional level effective as soon as possible featuring a few laptop and desktop network-ready configurations—from a single vendor, if possible, but with provision for periodically re-competing the lease. This lease should be based on a two-year hardware and one-year software life cycle and should include the pre-installation of a collection of productivity applications to be fully supported by the institution. These systems would be the only systems having a guarantee of support from the central information technology support organization in the absence of contractual relationships or other special arrangements.

If the costs of PC leasing cannot be mandated to the departments, then invest central funds annually to subsidize some portion of the total cost of the program to any participating unit as an incentive to retire old systems and to adopt the program as a standard business practice.

Provide any subsidies in accordance with the priority guidelines cited above and in consultation with appropriate faculty and administrative councils.

Offer centrally subsidized consulting and training services to ensure a basic level of competency with important applications. These services should include a suite of institution-specific templates, forms, and applications designed to increase institutional and individual efficiency and effectiveness.

Suggestions for standardizing universal access for the student body

Form a student information technology council to advise the central information technology support organization. The central support organization should then work with this student group and with the offices responsible for admissions, student aid, other student services, and academic advising to phase in a program to ensure ultimately that all full-time students will have personal and affordable access to an institutionally approved (supported) laptop configuration from the list of faculty/staff lease options that can be connected to the campus network at any time and from almost any place students study. This plan should recognize that some students are willing and have the means to pay the costs of a fully supported computer. But the plan should also equitably provide for those who cannot afford such an expense, whether as a personal purchase or an expense mandated by the institution in the form of a purchase or a fee (to cover an institutional lease).

If a comprehensive program cannot be effected in the short term, the central information technology support organization should work with offices responsible for admissions, other student services, academic advising, and a vendor—possibly the student store—to promote the (optional) student purchase or lease of laptop configurations from the list of faculty/staff lease options. These configurations would be guaranteed to work in wired residence halls and would be fully supported by the central information technology support organization.
Are Software Publishers in Touch with Higher Ed Needs?

by Glen McCandless

In preparation for his participation on a panel discussion at the Software Publisher’s Association conference, the author asked participants in CAUSE’s CIO listserv to share their concerns about software licensing, distribution, and development in higher education. This article reports the author’s recommendations to software publishers at the SPA meeting, based on that feedback, and suggests that more dialogue in this area is needed.

You’ll be surprised at the title of a panel session I participated in at the spring Software Publisher’s Association (SPA) conference in San Diego.1 “The Changing Nature of Higher Education” seems almost an oxymoron. You probably agree, change is not a word we usually think of when we’re talking about colleges and universities.

We were there to inspire dialog among 1,500 executives of software companies to change their software licensing, distribution, and development programs in light of the changes you’re experiencing on your campus. As one of the panelists, I was eager to share the suggestions I heard from several CAUSE members I polled before the conference.

The fact that the session attracted a crowd of eighty (in past years twenty were expected) was evidence to me that something might really be going on besides a lot of talk about change—something more than switching from quarters to semesters. I mean real change! And software, as you know, is at the epicenter of the dynamics, and an increasing financial consideration for colleges and universities.

I’m sure it’s no news to you that software purchases are consuming more of your budget. In fact, according to CCA Consulting (Natick, Massachusetts), current annual institutional spending for software is nearly $800 million now and will grow to over $1 billion in the year 2000. All this software purchasing is going on amidst challenges to the basic underpinnings of the institution. Revenue, productivity, accountability, competition—words associated with for-profit enterprises—are creeping into more discussions among academicians. And a lot of this is being driven by technology, ultimately software. It seems logical that the way you buy and distribute software to your campus community should also change, but for the most part, it is status quo.

Software publishers and higher ed consumption

What does this mean to you, the higher ed software consumer? Simply stated, the licensing and distribution options software publishers offer higher education buyers are outdated.

We still have publishers offering lab-packs (multiple copies of their products designed for individual users and one machine) and site-licenses based on a number of computers or the student population.

Software publishers are still trying to sell software products to students and faculty by putting stickers on their consumer retail products and distributing them through college stores. Only a few buyers and publishers have access to this channel.

These common practices don’t fit the new paradigm of universal access via a network or a diverse student population that is likely to be taking classes at home or in a lecture hall, around the corner or thousands of miles away. Our concept of a campus as a specific place is history. Frankly, the lack of new ideas for licensing and distribution is a missed opportunity for publishers and their customers.

Some suggestions for software publishers

So, where does this take us? At the SPA meeting, I made several suggestions to the audience of software publishers on behalf of higher ed software buyers, and I am interested in your feedback on these ideas.

Courseware publishers

Courseware has been a bust for the software industry. Costs to develop, sell, and market con-
tent-based software have far exceeded the sales of these products, and the result is obvious. We don’t have much commercial courseware on campus. Software publishers are unwilling to invest in creating good commercial courseware because it has not been a good business.

First, I suggested that courseware publishers work with their higher education customers to experiment with pay-for-use licensing programs. These could be implemented over a network with authentication technology, or, like textbooks, through a buy-back system. Publishers frustrated by the dismal economics of courseware sales to academic departments should wise up and realize that students buy course materials, but few of them keep the materials when the course is over. Why software publishers expect the average student to spend as much as or more than the cost of a textbook for a software program doesn’t make sense to me. Neither does trying to convince the departments to provide courseware to students. It’s not going to happen!

Second, I suggested that courseware publishers unbundle their content, license smaller pieces of it over the Internet, and charge for it on a subscription basis. If faculty could easily integrate a variety of content into their own syllabus, rather than have to license the “whole enchilada,” they might be more receptive to using commercial software in their courses.

Software industry in general

To all software publishers, I had some general recommendations with regard to their dealings with the higher education community. On top of my list was a cry I heard from a number of CAUSE members, that is, to license software based on concurrent use instead of lab packs, machine licenses, and the campus population. With networks, key servers, smart cards, and the like, this is the way to go.

Next, I suggested that publishers differentiate themselves by offering innovative support programs, especially in terms of upgrades, to make it easier for the folks responsible for managing software. Simple things like making manuals available for duplication or ordering can make a big difference.

I pointed out that EDI standards, long demanded by corporate customers with large transaction volumes, might be integrated into administrative applications to make it easier for students to transfer and access their records when they move from one institution to another.

When it comes to offering a total solution for the higher education customer, I challenged the software executives to work more closely with the computer hardware companies to create a total solution to the universal access issue. Loading dozens of “free” applications on the hard drive or stuffing them in the box doesn’t differentiate computer brands or software publishers any more. Rather than an added value, this popular strategy creates support headaches for higher education customers.

Finally, I urged the software industry to recognize that the higher education institution is more of a channel than a market, and that in their dealings with institutional buyers that this consideration be top-of-mind. Software publishers can partner with schools and allow them more freedom to distribute software to students and faculty in a way that benefits both the publisher and the higher education customer.

Suggestions for higher ed software consumers

So what suggestions do I have for you, the software buyer? The SPA is an important conduit to the people responsible for creating and licensing the products you buy. You can instigate more discussion among CAUSE members about software licensing and distribution, and make sure that the needs and ideas of higher education software buyers are brought forward to the SPA. One loud voice on behalf of colleges and universities could have a real impact on the thinking of the software publishers. As it is, the exchange of information is too fragmented to reach critical mass. The higher education community is a huge consumer of software and needs to do a lot more to influence licensing and distribution policies. Your voice is not being heard!

In closing, I ask you to take a few minutes to respond to my suggestions. What would you like to change about software licensing and distribution? Don’t assume that you don’t have the say-so. I think there are willing ears in the software industry anxious to understand your needs and respond to them. Let’s all work together to make software technology your ally in responding to the dramatic changes you’re faced with today in higher education. At the next SPA meeting, maybe the higher ed session will be standing room only.
Seven Points to Overcome to Make the Virtual University Viable

by G. D. Bothun

The emergence of the virtual university (VU), an electronic world where students can take courses without physical instruction, seems to be a foregone conclusion. Whether this new kind of university assumes the form of an Internet correspondence school or is composed of intensely interactive courseware that can effectively duplicate the mentoring process is completely unclear at this time. However, as in all true learning environments, no matter what the delivery mechanism or educational interface is, content and student engagement with the material remain key. Without that, there is no quality, and without quality no university, virtual or physical, has any purpose.

Much of the motivation for the VU stems from the perceived demographic need to accommodate more students at a time when public university budgets are squeezed to the point that constructing new facilities (or even modernizing extant buildings) is simply out of the question. Many states as well as individual universities are taking both small and large steps towards real implementation of virtual classes for credit. The University of Oregon (UO), for instance, has been offering a few Web-based classes over the Internet for UO credit since January 1996. Minnesota has produced a 150-million-dollar initiative towards their implementation of the VU. Many of the western governors have pledged to support a western states VU (which they call the Western Governors University—WGU). Software companies such as RealEducation.com have arisen to meet the need for electronic curriculum development.

In all these initiatives, there is a clear perceived demand for new course content and curriculum. As emphasized below, this is the critical issue with respect to the success of the VU, but it is also the one in which economic competition comes into play. This leads to one prediction—the VU initiative will set up a battleground between the commercial sector offering to provide content and university faculty, who are the real content experts. Success with the VU endeavor, therefore, requires merging these two entities to form a productive collaboration.

To date, the various VU initiatives are all “top down”—that is, the idea of electronic courseware and distance learning is largely being “imposed” on the collective faculty at the respective institutions by the administration or state officials. At best this is problematical, at worst, foolhardy. Successful changes in pedagogy need to originate from the bottom up, from professors who are actually involved with the daily aspect of using instructional technology in their on-campus classes. The advisory board membership for many of these VU initiatives is an admixture of university administrators, legislative liaisons, and corporate executives. While such a diverse partnership is necessary to make the vision a reality, it is not sufficient. Without strong guidance and design from the true content providers—the individual faculty members—the VU may well be dominated by the commercial sector acting as content provider. From the perspective of the individual faculty member this is both a threat to job security and a serious undermining of the institution itself. Hence, this is not a time for the typical faculty response of ignoring the potential problem. Instead, it is a time for faculty to take the initiative in the VU and to formulate clear and practical goals, with the emphasis on the correctness of the curriculum products. This will help to promote a seamless transition to the distance learning environment with no loss of quality in the curriculum.

As a practical guide, I offer the following seven issues that must be solved to make the VU a viable educational medium. These issues are listed below in alphabetical order, but all should be weighted equally in evaluating the probability of success with the VU concept. Some of these issues are standard ones, already under the charge of various task forces to address, while others are not so obvious. Each issue listed represents an obstacle or point of failure that could prevent the VU from duplicating the on-campus experience and hence impact the quality of its educational product. Again, from the faculty perspective, loss of quality is not an acceptable outcome. What follows then is a set
of issues that arise not from faculty whining, but from thinking about the problem and from actual implementation, development, and delivery of electronic courseware.

1. Access

The issue of access seems to have everyone’s attention. There are two forms of access: access to the curriculum products and access to curriculum experts who can provide feedback to the student. As an example of the first form of access, we consider the case at the UO where on-campus students are able to access the available courseware at a data transfer speed of 200 kb/second on average. Off-campus access via 28.8 modem is limited to about 2.5 kb/sec—almost 100 times slower. Electronic courseware that is rich in graphics, sound, and animation can be quite data intensive. For instance, one lecture in my Cosmology and Origin of Life class has approximately 50 MB (50,000 kb) of material (there are several animations) and my typical lectures have about 10 MB of material. Full download times are then from 4,000–20,000 seconds. This means the distance-ed student cannot access the whole curriculum product. While new technologies such as ISDN and HDSL will increase the bandwidth to the individual household, it is also clear that scientific visualization will be increasingly used as an educational tool.

The bandwidth problem, of course, is solved if we deliver the material to the distance-ed student via a CD-ROM. This is the digital equivalent of the traditional correspondence course, and like that course, the curriculum is not easily updated nor very interactive. This mode of learning is passive, and the distance-ed student remains a detached learner. This leads to the second access problem, as these students will never have the opportunity to ask questions in class or even come to office hours. Their counterpart on-campus students at least have the option of a full-duplex interaction with the professor. While the use of e-mail is very good for the basic exchange of information and answering questions, that medium alone does not produce the kind of spontaneous discussion that can lead to effective learning. Video conferencing over the Internet is not a practical substitute for this facility, and of course would be enormously taxing on the professor’s time if done asynchronously.

2. Accreditation

When Microsoft University becomes a player, will they be properly accredited? Does outsourcing of content development, as in the case of the University of Colorado partnership with RealEducation.com, produce a curriculum that can be accredited by other schools? What happens when several universities contribute to curriculum for one large VU (e.g., the WGU)? Where do the credits go? How are the finances done? What is the reward system for individual faculty contributions to electronic curriculum, and how can intellectual property rights be maintained and respected? These questions are all serious challenges from the administrative point of view. Each question must be resolved so that a clear structure emerges in advance of the implementation of the VU. Faculty control over content and curriculum is the foundation of the typical physical classroom. How will this foundation be preserved in the VU?

3. Curriculum Development

Will the Internet evolve like television—a content-free, ubiquitous-access network? Programming the curriculum for the VU is the biggest of the issues raised here. Who does that, and what will the interface be? Will it be truly interactive courseware that is better than can be done on campus, or will it be passive materials that render the VU little more than a digital correspondence school? Interactive multimedia courseware development is a labor intensive operation. There are great things that can be done, but a true quality educational project is going to require a synergy between faculty expert, programmers, and digital artists, as well as the time to do the project. This is what is worrisome about the top-down edicts. It would be much better if faculty develop this project for improving the on-campus educational experience and then let the institution search for the channel to deliver it remotely.

Creating the VU without a solid curriculum core strongly compromises its integrity. While the organizers of the VU enterprise certainly do not intend this, at the same time they must realize that a solid curriculum core requires an institutional investment in faculty expertise to program in this new content medium. If content development is outsourced to software companies, with or without faculty consulting, why would individual faculty members endorse the VU? This begs the question, is the VU sufficiently removed from the real university that such an endorsement is not required?

4. Evaluation

The quality and rigor of an undergraduate class is highly dependent on the kinds of examinations and assignments that can be given. “Mickey Mouse” courses are largely such because trivial assignments and examinations are given. Constructing a rigorous, fair, and com-
prehensive exam is not an easy process. It is clear that standard exams cannot be given to a remote audience unless proctoring is arranged, and that can be an obstacle that removes much of the flexibility of distance education. More to the point, if the distance-ed students take a separate curriculum from the on-campus class, there will be no adequate baseline from which to determine grades, if indeed grading becomes part of the VU standard.

At the UO, I have solved the examination problem by developing a Java exam applet that ensures authentication and prevents cheating. This, however, was a very time-consuming effort and not all students can use it, since they are not accessing the material with a Java-aware browser. I have tried interactive testing via e-mail or even online discussion, but that has proven to be limited. The Java exam applet allows me to deliver to the remote student the same test that the in-class students take, in the same amount of time. When designing electronic curriculum for distance education, it is very important to build in a robust and reliable testing infrastructure. The lessons learned to date indicate that if this is done, the distribution of grades between the distance education students and the on-campus students are identical. This should be the outcome and is an important consistency check on the quality of the curriculum and the distance-ed learning process.

5. Marketing

The creation of a VU presupposes a clientele. From the last eighteen months of distance education at the UO, it is our experience that this clientele is very limited. Real market research must be done to properly identify the target audience. Is the target audience really the over-25 student who can’t come to campus? Is it the employee in business or industry who wants some form of continuing education to comply with job requirements? Is it the traditional 18- and 19-year-olds who otherwise would be socializing on campus? Is it the 16- or 17-year-old in high school who seeks to obtain real university credit in order to decrease time to degree once s/he enters the university? Is it the lifelong learner whose curiosity and desire to learn will be piqued by the course offerings of the VU? The UO experience to date is that it is all of these, with about equal mixtures, that is, there is no one model that successfully reproduces the distance-ed clientele. This makes it difficult for the UO to directly respond to individual learner needs for curriculum, as they are many and varied. The fallback position of building a curriculum and hoping they will come seems risky at best. Whatever the target audience turns out to be, it seems clear that it needs to be identified.

6. Mentoring

Part of the discussion around the VU involves full-degree programs. How is it possible to offer a full-degree program entirely via electronics? Certainly it is possible and maybe even desirable to offer the basic core course foundation in this manner, but every degree program I have ever been associated with ultimately involves a one-to-one mentoring relationship with an individual faculty member. Indeed, the very quality of the degree depends on the depth and scope of this mentoring program. In my fields of physics, astrophysics, and environmental science, I can’t imagine conferring a degree on a student who only took courses remotely. Even if it were possible, the interactive aspect of the mentoring process, if duplicated electronically, would require an enormous investment of faculty time. While the concept of network is great—no place and time restrictions—the converse of students having interactive access to the professor in a manner not bound by time or place is utterly undesirable. Few professors, I think, would be willing to commit to a teaching endeavor that required them to spend more time than the time they currently spend in on-campus teaching. My experience with distance education to date clearly shows that the mentoring/interactive aspects that I think are necessary to ensure quality are also quite time consuming. With any more than a few students, the process of balancing one’s time between teaching the physical classes, doing research, performing endless committee service, and having to be available at any time to the distance education audience is taxing at best and insane at worst.

7. Pricing

This last issue deserves just a brief comment. Obviously, electronic courseware and credit granting must be priced at a sensible level. In fact, one can argue that reduced cost per credit hour is the main incentive for the student to take virtual classes. At the same time, if this endeavor is seen as a real revenue stream for the university, then it is very likely that competition among different universities will result, and the distance-ed student buys the “cheapest” educational product instead of the best distance-ed curriculum product. Certainly we do not set our tuition rates entirely by market-driven factors, but instead the tuition price is supposed to reflect the total quality of the on-campus educational experience. The bottom line is that if a purely business or

“In my fields of physics, astrophysics, and environmental science, I can’t imagine conferring a degree on a student who only took courses remotely.”
Intellectual Standards in the Information Resources Industry

by Mark Sheehan

December started out badly for me. Within a few days I reviewed a really disappointing book, then listened to a really disappointing speech. Though unrelated in any other way, both were in the context of information resources, flavored with higher education. The disturbing thing was that both lacked integrity. They showed—almost flaunted—a lack of attention to intellectual standards.

The book, by a computer science professor, was a vapid popularization of topics in information technology, blending sensationalism and opinion, frequently contradicting itself, and having little other apparent purpose than the author’s glorification of his own wit. The speech was better. It made excellent points. But those points were supported not so much by carefully researched data as by metaphors drawn inappropriately and out of context from fields clearly outside the speaker’s area of expertise (but coincidentally well within mine). The effect, on me at least, was to tinge with doubt even the most intuitively valid points the speaker made.

As I griped to colleagues and friends about these disturbing events, I found that many of them had been noticing and feeling the same things in other, similar contexts. And as I tuned into discussions on my campus and in the media, I noticed that a lot of us in higher education are starting to develop a very bad feeling about the quality of the information we receive and about current standards for intellectual and academic integrity. I began to wonder what’s going on in higher education, and what role information technology might be playing in the apparent lowering of our standards.

Technology has a long history of enabling intellectual dishonesty and otherwise seeming to subvert the academic process. I think of the way the printing press made it possible to fake documents, or the way photographic technology made it possible to fake pictures of the Loch Ness monster. On a smaller scale, closer to our academic homes, the typewriter made an individual student’s work more anonymous. The photocopier made it easy to duplicate someone else’s work and pass it off as one’s own. The calculator was seen for years as a threat to basic math competency, as I assume the slide-rule and abacus were before it. Microelectronics have enabled all kinds of high-tech cheating. In this context, pulling a term paper off the Internet is just the latest technique in a centuries-old bag of tricks.

It would clearly be a mistake to blame technology for academic dishonesty. The National Rifle Association (with which I happen to agree on this one minor point) says, “Guns don’t kill people; people kill people.” I’ll paraphrase that here as “Technology doesn’t lie and cheat; people lie and cheat.”

But there may be more subtle ways in which technology promotes a decline in intellectual standards. The electronic media, in many complex ways, have led us to expect quick, slam-bang information exchange. The sound bite is the best example. Our collective attention span seems to be shortening. Many of us have become impatient with extended discourse that lengthens meetings, with elaboration of ideas, and with reading material that is not presented in a series of bullet points. We focus on the “executive summary” as if somehow the highest ranking opinion on a subject should be the least, or the most shallowly, informed.

Conference planners are finding it increasingly difficult to get speakers to provide written versions of their talks. Bullet points that worked well for the speaker as notes don’t provide the same window into the speaker’s thoughts as a well-written prose article. In the era of sound bites and bullet points, what happens to the sharing of ideas and thoughtful analysis? What about the domino effect of one person’s ideas sparking others’? These concerns extend to the archiving of listerv discussions—should the sponsor preserve the literal list of messages on a topic, or should someone sift through them and produce a summary or analysis?

Clearly one doesn’t want to risk turning away a dynamic speaker who is simply too busy to write a paper for the conference proceedings. But how much is lost when only the 50 or even 200 people who can attend in person benefit from a Great Presenter’s ideas, and the rest of us (and the world!) remain uninformed?
The average World Wide Web home page provides more evidence that our industry, and the popular culture it spawns, is growing lax in the application of intellectual standards. The similarity of the Web to a library has not been lost on the information industry. Nor has the fact that the average integrity of what’s on the Web is a lot lower than what’s in most libraries. The problem, of course, is that on the Web virtually anybody can be a publisher. There’s little peer review of Web publications. Editing is generally up to the individual publishing the page. No matter who you are, you can publish whatever you want. There’s a famous New Yorker cartoon, the caption of which is: “On the Internet, nobody knows you’re a dog.”

A few months ago my hometown newspaper took up this topic. The reporter chose to pan the Internet and the Web as sources of valuable information. The article suggested the Internet was a source of “dangerous ideas.” This seemed a needless exercise to me. I don’t deny there’s useless stuff on the Web, but just a little exercise of “critical thinking skills” should be enough to keep most people from falling for the hype. (You wouldn’t go to the tabloid racks at the supermarket to research a serious topic; why would you meander through some lurid Web site if you wanted legitimate information?)

But there is hype on the Internet, and inaccurate information, and it’s written by sources that are far from authoritative. What worries me is that some of us in the information resources professions have fallen for the hype ourselves. The faculty author of the book and the successful commercial author who made the speech I mentioned at the beginning of this article are two examples of people who have found themselves able, for one reason or another, to publish successfully in the print media. Like thousands of people who have found Web publishing gives them an easy outlet for their own opinions, they seem intoxicated by this ease. The author and speaker seem to me to have abandoned some of the standards for information interchange that have been part of our culture, at least in academe, for centuries.

Please don’t get me wrong. I like the freewheelingness of the Web as much as anyone, and I would never want to make it harder to publish there. T. Matthew Ciolek, publishing in a recent issue of Educom Review, suggests that “serious and energetic remedial steps” are needed to snap the Web into line, lest it become “a poor [multimedia mediocrity].” I disagree. A look around any bookstore, through any collection of alternative magazines and newspapers, or even through any library will reveal mediocrity galore. Besides, one person’s mediocrity is another person’s stroke of genius; who would you trust to make that distinction for you?

In any medium, including the Web, I believe free choice and free market mechanisms along with a Darwinian survival of the fittest will ensure that the most relevant, most useful, most valid information will persist. The less meaningful will generally be an easily overlooked annoyance and will eventually be priced out of the market (to be replaced by the next fly-by-night bit of trivia). In their choice of information sources, people will always need to exercise individual judgment based on critical thinking.

For those of us in the higher education information resources arena, what seems more appropriate than imposing controls is to set good examples at our institutions. Many of us control or influence our institutions’ Web presences. We consult and collaborate with sister institutions in our communities. Some of us have formal outreach and extension duties built into our missions. Most of us get involved from time to time with the local media, professional organizations, service clubs, and the like. Many of us take on consulting assignments outside our regular jobs. In all these venues we have opportunities to influence the proportion of signal to noise in the information we broadcast. Hundreds if not thousands of years of academic standards stand behind us if we urge (and pay) attention to accuracy, completeness, timely updating of facts, responsible use of statistics, adherence to time-honored methods of investigation, responsible, verifiable reference to other people’s work, and objective reporting of our conclusions.

Here are a few more ideas to help us support higher intellectual standards in our industry.

► Avoid instant expertise. Many of us are at the cutting edge of our fields. We’re asked for our opinions by the masses who lag behind us. It’s tempting to talk or write beyond our actual areas of expertise. To know a little about a new technology is to appear to the masses to know a lot. It’s an old aphorism that “a little knowledge is a dangerous thing.” Let’s keep that in mind as we talk to the press, to our peers, to our clients, to our customers.

► Consult close to home. I don’t mean to suggest that travel is bad. I mean that if you’ve had some successes and you know why you were successful and you didn’t just manage to squeak past the horns of the dilemma that gored your peers, then you should consult. The farther afield you go—the farther from your true expertise and

the more serendipitous your successes have been—the more you contribute to the decline of standards in our industry.

➤  Respect credentials. The cynic’s view of a college degree is that it’s a credential purchased with tuition dollars and by the sacrifice of one’s early-to-mid twenties. We need to remember that credentials earned in higher education or through long experience in a particular field are worth something. As you shop for consultants, look for seasoned veterans with strong credentials.

➤  Demand proof; demand performance. After fifteen years of inhaling vaporware, most of us have developed a tolerance for hype. Some of us still get a little giddy about the promises of new systems, and in that we are fair game for vendors who lack integrity. A healthy skepticism is a good thing to have, as is an expectation that systems will perform as advertised. Hold the vendor accountable. Promise yourself you won’t pass along unverified vendor claims or other information. Hype is a primary enemy of integrity in information technology.

➤  Take a stand. Standards can decline only if we let them. Look at your own game. Look at the games your staff are running. Expect a lot of yourself and expect a lot of them. Your honesty will foster theirs. Their honesty will support yours. If we keep standards high in our own organizations, we’ll add a piece to the larger puzzle our academic brethren are trying to solve. We’ll become a part of the solution and we’ll lower the profile of technology as part of the problem.

“Hype is a primary enemy of integrity in information technology.”

Data Warehouse (continued from page 40)

The process of constructing a taxonomy of administrative activities will document which campus offices perform which administrative activities, and is the first step toward building an institutional information architecture. When undertaken as suggested earlier in this paper, the process can be at least as important as the product. Individuals throughout the campus will become more aware of all of the administrative processes and of their interrelationships.

The building and maintenance of a campus data dictionary requires even more detailed work than the taxonomy, but is no less important to the institution’s information architecture. The process will undoubtedly uncover many discrepancies in data definitions within the campus community, so it is important to have an appropriate forum for resolving differences. It is also important to have a top level information policy group to emphasize the importance of maintaining data in formats that are consistent with institutional standards.

Responsibility for the construction and maintenance of the campus information architecture is typically lodged in the administrative information systems unit, but the task is far too important to be relegated to a technical solution. An office with a campuswide perspective and a non-technical view of information should lead the endeavor. The effort should be supported by an information policy and advisory committee structure that represents the perspectives of all information users on the campus.

Participation in the committee structure surrounding the construction and maintenance of the campus information architecture can also enhance intra-campus communication about data and information and improve individual office productivity significantly. The availability of the institutional taxonomy and data dictionary as dynamic documents on a campus intranet will provide current and future benefits to the institution, as every individual has access to, and is able to understand, the appropriate information to perform his or her function.
Learning about Distance Learning

by Andrew C. Lawlor and Jeanne Rodier Weber

This article provides the history and goals of a distance-learning demonstration project at Edinboro University of Pennsylvania, as well as technical considerations, coordination activities, and instructional issues faced by the faculty. The experience gained through the initial project enabled the University to later offer credit-bearing courses on a regular basis via video conferencing.

As a part of the mission of the Pennsylvania State System of Higher Education (SSHE), its fourteen member institutions were given an opportunity to explore the practicality of using distance education to deliver instruction to remote areas of the state, and to jump-start a sustained effort in rural education.

In December of 1994, the SSHE published a request for proposals to provide grants for demonstration projects around the state during the following spring semester. Edinboro University collaborated on a proposal with sister institution Clarion University and the Warren/Forest Higher Education Council to provide a series of continuing education seminars to nurses in Warren County, where there was no institution of higher education.

The Professional Nursing Series was a logistical application, since both Edinboro and Clarion Universities have departments of nursing and serve a large rural geographic area in Northwest Pennsylvania. In this region many nurses staff hospitals, clinics, home health agencies, long-term care facilities, doctors' offices, and public health departments. Access to continuing education offerings is difficult because of the need to travel long distances, usually over secondary roads. Yet emerging health-related information, new health care technology and delivery systems, and the need for continuing education credits to keep certifications in force require nurses to participate in continuing education.

The overall goals of the project were to deliver educational programming to a location that traditionally has had difficulty accessing higher education, to try out the process of video conferencing as a practical solution to distance education, to train faculty and build interest and enthusiasm for distance education, and to experiment with adapting materials and methodology to accommodate video conferencing.

Since Clarion University had already begun experimenting with video conferencing technology, Edinboro University was able to quickly respond to this need without having to test and evaluate equipment. The proposal was funded by the SSHE for the lease of PictureTel video conferencing equipment for the Edinboro and Warren sites during the months of March, April, and May of 1995 for the demonstration project. The grant also paid for the installation of video conferencing lines in an instructional building and covered the cost of monthly line charges and per-minute charges when a call was established.

Technical considerations

Video conferencing, which provides two-way interaction via a television screen between parties at two different locations, has recently become more available due to decreasing costs of the technology and the telephone network infrastructure needed to support it.

What is needed for a video conferencing program? While both desktop and group models are available, Edinboro chose the group arrangement. In this configuration, each unit contains a television monitor, a video camera (usually attached to the top of the monitor), a “black box” containing the compression and digital/analog equipment, a telecommunications network interface, and a keypad for controlling the unit. A document camera, while optional, provides for the transmission of document images and other objects and also acts as a transmittable writing board.

Along with equipment, the appropriate telecommunications network connection is required. By using the local phone company for this service, connections can be made all over the world by dialing, as you would a conventional telephone, with other video conferencing units around the block or around the world.

One difference between regular television broadcasts and video conferencing is the quality of the image. Unless a high-speed connection...
tion is purchased (which is usually out of the realm of possibility for many higher education institutions, due to high costs) and the networking equipment procured to handle the high speeds, the image quality is inferior to broadcast TV, especially when displaying motion. Video conferencing is possible due to the conversion of the analog video signal into digital bits of information, compressed to send over the line quickly enough for the audio and video to keep in synchronization. This process leaves the image, especially those portions that have movement, somewhat blurred. Once the image stops moving, however, it becomes more clearly defined. While one might assume this would have a negative effect on student learning, studies have found that participants quickly adapt to the image.

Sound and time delay are two other aspects of video conferencing that are different from broadcast video. While, as noted, the audio and video are in synch with each other, a time delay of approximately four-tenths of a second occurs between the time one person speaks and when a person at the other end hears and sees the action. This delay, while disconcerting at first, also becomes manageable and is quickly assimilated by the participants. Sound quality itself is very high and tends to help compensate for the lack of video image quality.

Coordinating the effort

Coordinating the development and delivery of continuing education offerings via distance education technology, while not difficult, was time consuming and occasionally frustrating, particularly considering a short timeline of approximately two months from notice of funding to anticipated program delivery. Expert support from the universities’ technicians removed a great deal of the concern that would normally accompany a first attempt involving new technology. Technical support was provided in both telecommunications and video production areas. Support from the University’s telecommunications staff enabled contact with the local phone company for both installation of switched 56KB data lines (ISDN was not available in our area) and troubleshooting once the lines were installed. The vendor also provided training and support to the Edinboro staff, which greatly eased the initial installation and use of the equipment.

Edinboro University’s TV and Media Services group assisted with the audio and video components of the project. While it was originally expected that lighting and sound control would be necessary (and for this reason, the site selected at Edinboro was the university television studio), University participants were pleased to learn that normal room lighting and audio conditions were not only acceptable but preferred, as the equipment is designed for such environments. Another area of concern was the ongoing monitoring and operation of the equipment. Were technical staff members required to be present on a constant basis? For the demonstration project, it was determined that such monitoring was beneficial, and while the instructors became familiar with the operation of such features as zoom control, camera selection, and the document camera manipulation, a technical person was positioned in the wings to assist, should the instructor need help.

After the demonstration project, it was decided to train student workers to provide basic operation and troubleshooting, as the courses tend to be conducted in the evening, when regular staff are not generally available. The remote end should also have a counterpart, in the event that the equipment requires adjusting or restarting. This technology, like personal computers, has been designed for non-technical operation (“for the masses”) and therefore the additional expense and drain on professional staff should not be necessary.

Armstrong and Sherwood, in their article, “Site Coordinators: A Critical Component in Providing Quality Nursing Education at Distance Sites,” detailed the extensive role of the site coordinator. Site coordinators from the Nursing Departments at Edinboro and Clarion Universities and the Warren-Forest Higher Education Council played crucial roles in making the Professional Nursing Series a reality. They met to organize course content, faculty, scheduling, and the application processes needed to obtain the Pennsylvania Nurses Association’s (PNA) approval to award continuing education credits to course participants. Based on the site coordinators’ knowledge of the expertise available within the respective faculties and the needs of nurses in the Warren-Forest area, an initial list of possible topics and presenters was identified, as well as a ten-week schedule of two-hour offerings during the spring of 1995.

Site coordinators from the universities then expanded the list of possible topics with the assistance of the respective faculties, and sent the lists to the site coordinator at the Warren-Forest Higher Education Council. She met with local nursing contacts to select those topics which were felt to best serve the needs of nurses at the remote site. The university coordinators then alerted faculty to the chosen topics.

Faculty developed their own content outlines, which were submitted to the PNA with

necessary cover materials organized and developed by the respective university site coordinators as part of PNA’s application process. The submission and subsequent approval by PNA was used as a marketing tool to attract students. Information was also sent to Edinboro University’s Continuing Education department for creation of a brochure to advertise the offerings and to later assist with registering students.

**Faculty preparation and participation**

Some of the faculty, support staff, and administrative personnel participated in a workshop at Clarion University to learn about the new technology, and local workshops were also held to teach each presenter about operating the equipment and other issues related to program delivery. Other issues covered included preparation of camera-ready visuals to augment audio content, adaptation of teaching styles for effective interactive delivery, and discussion of options should equipment failure occur during the presentation.

Because of the possibility of loss of the audio, visual, or total contact with participants at the remote site, as well as to enhance their presentations, presenters developed comprehensive packets for participants, including detailed content outlines, extensive bibliographic references, other supportive materials, and evaluation forms. The packets also included information about the universities’ other nursing degree programs and a flier publicizing other offerings in the Professional Nursing Series. The packets were delivered (prior to the presentations) to the remote site coordinator, who managed registration and the classroom environment and sent completed evaluation materials and attendance documentation to the university coordinators.

Creating rich faculty-student interactions via interactive television was as much of a concern of faculty as it would be in face-to-face contact in the traditional classroom. One of the most useful strategies proved to be mapping students by name on a seating plan as they introduced themselves from the remote site. This allowed faculty to address students by name.

Seeking interaction early in the program by eliciting participants’ reasons for attending and their past experiences with the topic being presented engaged and relaxed participants, and dispelled the prevalent feeling that they were talking with an appliance! The strength of interaction as an aid in the instructional process was cited by Catherine Fulford and Shuqiang Zhang as a critical predictor of satisfaction in distance education.

Adapting printed materials such as conventional overheads and handouts for the document camera was another concern of faculty. To be intelligible at the remote site, print must be large and clear, with no more than six “bullets” or items per page.

Photographic images must be exceptionally clear and not overly complex. The use of videotapes purchased for classroom use becomes complex; it is often a violation of copyright law to project these same videotapes over interactive television lines without permission of the holder of the copyright. Since our timeline did not allow for obtaining this permission, no excerpts from videotapes were incorporated in any of the presentations. Later courses sometimes used a technique whereby two valid copies, one at each location, were played simultaneously, thereby avoiding the copyright issue.

**Project results**

Participants were asked to evaluate each offering according to several criteria including quality of content, relevance of content to program objectives, and effectiveness of teaching methods. All participants evaluated each criterion for each of the offerings in the range of 4–5 on a five-point Likert scale (five was “strongly agree”).

The experience of participants, coordinators, faculty, and technical staff indicated that the expansion of distance education at Edinboro University is not only viable, but provides a means to reach potential students who otherwise could not attend college due to time and distance constraints. It was for these reasons that Edinboro University purchased the PictureTel equipment it leased for the initial demonstration nursing education project and began offering credit-bearing courses leading to a bachelor’s degree at the Warren site.

With this initial success, Edinboro University has since provided seven full-scale, three-credit courses over three semesters using interactive video conferencing. With each occurrence, more is learned about effective teaching and management of this medium, enabling us to continue striving to provide the best educational experience for students in nearby rural communities.

---

Edited by Brian P. Nedwek
(Society for College and University Planning; 1996; member $50, non-member $60; 153 pages)
ISBN 0-9601608-3-3

Reviewed by Cynthia Rolfe

Postsecondary institutions are beginning to recognize the value of planning strategically to address the paradigm shift to a learner-centered orientation. This change from the traditional provider-centered mode has been encouraged by public scrutiny and a shrinking financial resource pool.

Doing Academic Planning, the first in a three-part series published by the Society for College and University Planning (SCUP), is an effective compilation of articles that focus on procedures and tools to assist an institution in strategically moving toward a more service-oriented model. The book presents eight areas of higher education planning, each of which is discussed by leading administrators in post-secondary institutions. The topics include environmental scanning, curriculum planning, enrollment management, human resources planning, planning for information technology, student services, academic planning within the larger context, and linking quality and accountability. These issues are directly aligned with the areas of planning in which I find myself regularly involved.

The value of this volume to information technology professionals is evident in the current surge in network scholarship. Information technology has moved from the basement to the board room in both academe and business. Information technology professionals have become integral to an organization’s planning process. This new-found responsibility, however, presents a challenging transition for computing directors and chief information officers who must recommend and implement technology from a learner-centered perspective. I have used the volume as a quick access to information about functional areas in which I am not intimately involved, but where I am assisting in technology planning.

Doing Academic Planning is designed for the busy IT professional. Tools for planning are presented in articles rather than chapters, offering the flexibility to read just one of the fourteen presentations at a sitting. In addition, each article is designed for readability within the context of the others by using a structure that discusses core planning questions, basic concepts, planning models or approaches, action issues, recommendations, and print and electronic references. Readers may easily select topical areas and foci, making this a quick resource for planning. The book’s structure lets me compare information regarding others’ experiences in academic planning without spending inordinate amounts of time searching for examples.

Even if the reader is not directly involved in planning for one of the topical areas presented, the information contained in this volume will be beneficial to an overall understanding of planning in an academic organization.

Reviewer Cynthia E. Rolfe is Chief Technology Officer at the University of Central Oklahoma. She is a member of the CAUSE Editorial Committee.

Why Things Bite Back: Technology and the Revenge of Unintended Consequences
by Edward Tenner
(Alfred A. Knopf, 1996, $26, 346 pages)

Reviewed by Susan Foster

Edward Tenner has given us a multi-faceted view of technology’s unintended consequences as well as a thoughtful enquiry into how they come about. The examples he explores affect global public interests and include medicine, the environment, agriculture, computerized offices, and sports.

Common among his illustrations are the compounding complexity and intensity that technologies bring to all that we do. As we apply technology to intensify an outcome—antibiotics to suppress disease; new varieties of agricultural products to increase food production; energy production and other products to meet our demand for comfort, safety, and efficiency; tools to enhance individual and group productivity and power—complexities emerge that spawn unintended consequences.

On the one hand Tenner seems to be saying that technology has a determinism of its own over which we must be eternally vigilant. On further reading, however, he is really warning us about ourselves—warning us against technological arrogance and ignorance of the very nature of things. He urges us to understand as much of that nature as possible—not to anticipate its every nuance, but to be prepared to cope nimly. He calls this substituting brains for stuff, subtlety for bombast, finesse for the frontal attack.

I found this an especially encouraging perspective to apply to information technology
which, more than ever before, offers us opportunities for the light touch—for intelligence delicately applied.

**Reviewer Susan Foster** is Vice President for Information Technologies at the University of Delaware and current chair of the CAUSE Board of Directors.

---

### The Absolutes of Leadership
by Philip B. Crosby (Pfeiffer & Co., 1996, $19.95, 144 pages)
ISBN 0-89384-276-1

Reviewed by Darryl Huish

I will recommend *The Absolutes of Leadership* by Philip Crosby for two reasons. The first is that the book provides concise ideas that are relevant for any reader, whether in a position of leadership or not. These ideas can best be called food for thought or catalysts for pondering one’s own leadership style as well as the styles of others.

Crosby asserts four absolutes of “true leadership”—a clear agenda, a personal philosophy, enduring relationships, and worldliness. As I measured myself against his absolutes, I had a framework for a fresh perspective about my strengths and my soft spots.

My second reason for recommending this book is that it is truly a “quick read.” Counter to the trend of 500-page books to be digested over several evenings, this book can easily be read and understood in less than two hours, even while allowing extra time for chuckling at the cartoons.

These strengths—food for thought and brevity—also provide the basis for a caution. Readers looking for a fail-safe menu for developing leadership skills may be disappointed. Crosby’s model was a little simplistic for me. For example, he flatly states that there are five types of leadership styles, and provides labels and characteristics for each. While I saw some elements that applied to my style and to those leaders around me, I found mostly shades of gray and partial matches. Because of Crosby’s sparse style, I found myself wondering if leadership could actually be developed or, instead, only observed and labeled. Consider reading *The Absolutes of Leadership*; you will gain insights, but don’t expect a quick fix.

**Reviewer Darrel Huish** serves as Director, Applications and Consulting, within Information Technology at Arizona State University. He is currently a member of the faculty for the CAUSE Management Institute.

---

### Virtual University
(continued from page 57)

In sum, this article has raised serious issues about the quality of the curriculum product that the VU can offer as well as the role of faculty in the enterprise. To be sure, many large survey courses could probably be done equally well electronically, as such classes are often vacuous assemblages of students trying to satisfy some distribution requirement. These information-oriented classes are likely the most conducive to electronic duplication. But to date, no one has succeeded in the electronic duplication of the mentoring process, arguably the one attribute which has let the university stand as an academy for 1,000 years. While I welcome the coming of a new form for this academy in the next millennium, issues of quality and scholarship must remain the foundation, even in the digital world. If not, then we will continue to cultivate a climate of entertainment instead of education and continue our slow slide to ignorance.

The virtual university has tremendous potential to improve the way that faculty teach and students learn, but it must be a cooperative venture of content providers and instructional designers with clear goals in mind and a willingness to engage in the kind of altruistic sacrifice that marks today’s quality university faculty. Anything short of this may well reduce the virtual university to the standard of television.

**Related resources:**

*Teaching with Electrons: The Development of Networked Courseware at the UO* (http://zebu.uoregon.edu/special/cause.html)

*Networked Instruction in Physics* (http://zebu.uoregon.edu/special/cip.html)

*Western Governors University* (http://www.westgov.org/smart/vu/vu.html)

*Oregon Community College Distance Education offerings* (http://www.lbcc.cc.or.us/occdec/chart.html)

*The IBM Global Campus* (http://ike.engr.washington.edu/igc/)

*The Minnesota Initiative* (http://www.ot.state.mn.us/)

*RealEducation* (http://www.realeducation.com/)

*Silicon Campus: Silicon Graphics* (http://www.sgi.com/silicon-campus/)

“…to date, no one has succeeded in the electronic duplication of the mentoring process…”

---

CAUSE/EFFECT
Summer 1997
Today, **Point Loma Nazarene College** is allowing faculty-only access to our CARS student data through the Web with access to class lists and a comprehensive student advising system.

This fall we plan to offer students the option of registering for spring term through the Web. The primary issues we have encountered in implementing this system are:

1. The impracticality, if not impossibility, of maintaining firewalls as we look at providing services to a diverse community of commuter students, faculty, staff, parents, alumni, etc. from their homes, businesses, and places unknown.

2. Automating/tracking Web-access programs with our current software package—our software vendor has recently provided tools to track these additions that need maintenance along with the rest of the core package modules.

   Jeryl D. Harder  
   Director, Information Services  
   jerryharder@ptloma.edu

**Plymouth State College** is currently providing access to student academic records via a World Wide Web interface. The system interfaces with PSC’s production student information systems (Campus America’s POISE) to provide access to the same information used by the various offices that are the source of the information. The system is called SILAS Plus. Access is obtained by entering a student ID and PIN (maintained by the registrar), and is limited to the College campus.

The office of Information Technology Services (ITS) is in the process of implementing network computer workstations throughout campus and kiosk-like access points to SILAS and other Web-based information. ITS is also beta testing a Web-based system for Faculty Advisement purposes, based on similar tools.

   Steven C. Burrell  
   Director of Information Technology  
   steven.burrell@plymouth.edu

At the **University of Wisconsin-Madison**, students have access to a range of services via a Web application known as EASI (Extended Access to Student Information). Students can see their cumulative academic record semester by semester. They can request that an unofficial version of their transcript or a degree audit report be sent to their e-mail address. Our course timetable is also available on the Web, and students can look at and print their current semester course grid, including final examination information. They can update their address information, and information about fines and holds on their records is also available to them.

A major concern was security of confidential data. We have several computing labs where students make use of EASI. We feared students would not thoroughly close the Netscape application and that the cached ID and PIN would be available to the next student. This was addressed by having the student click on a box labeled “I ACCEPT” after (presumably) reading a warning. The warning tells the student how to back out completely from Netscape. The student ID and name are not displayed on any of the panels and are not part of the e-mail when a transcript or degree audit report is sent.

   Sara Richards  
   Manager, Student Academic Applications  
   Division of Information Technology  
   sara.richards@ccmail.adp.wisc.edu

**At Carnegie Mellon University** we have implemented Web-based applications for inquiry of student information, inquiry of housing availability, degree audit, student course registration, and online submission of grades. In the near future we will add application for admission and inquiry of admission status over the Web. We also have static pages with the course schedule and course catalog information on the Web.

All of the Web applications are considered easy to use and have a high level of acceptance on the part of the students. We handled security issues by using a standard campus computer identification for authentication and the Netscape enterprise server for encryption of data. A current issue is performance of the online registration system during peak loads (9,500 server hits per hour). This issue has yet to be resolved. The other issues with Web registration are process issues—control is taken away from the registrar, and is limited to the College campus.

   Martha Baron  
   Director, Information Services  
   mbaron+@andrew.cmu.edu

At the **Ohio University** University is providing “secure” transactions for Web-based applications in all areas including student services. Ohio University is in the process of implementing DCE, which will ultimately provide for the encryption and authentication needed for Web-based applications.

In order to provide the necessary security now (before we are in a position to fully implement DCE), we recently enabled our students to request a copy of their schedules and their grade reports via the Web, with the copy being sent to their e-mail account.
One of the major side benefits of the increased popularity of the Web is the potential for the reduction of printed materials such as grades reports. Ohio University will be in a position, if it chooses, to eliminate grade mailings entirely in the near future, opting, instead, for students to access their grades via the Web or a voice-response application.

Don Sweet
Associate Director, Computer Services
dsweet1@ohiou.edu

University of North Carolina-Chapel Hill has installed the following Web-based student services (see http://www.unc.edu/student/student-inf.html):

The Student Information Browser allows students to access their records directly from the university’s student database over the Web. Through use of their student identification number and password, students can view their class schedules, grades, GPA, cashier’s account, holds on their academic record, addresses, and academic progress via degree-audit capabilities. In addition, students can update addresses and directory/privacy flags.

Admission Applications allows students to obtain admission requirements and apply for admission to the University over the Web by accessing the University’s Undergraduate or Graduate Admissions Web page.

The major issues encountered in implementing these Web services for students involved security, direct Web access to the IDMS student database, and procedural control of the release of sensitive academic information. The security had to be tight enough to prevent unauthorized access and yet easy enough to promote use. Direct Web access to the student database required the development of interface programs between the Web server and the mainframe database. Procedural control was a concern of the student services offices who feared that students could misinterpret the information if they obtained it without assistance from their offices.

Robert W. Culp
Director, Administrative Applications
Administrative Information Systems
bob_culp@unc.edu

The Web application we deployed at Indiana University is called INSITE (Indiana Student Information Transaction Environment). This application connects students with registrar, bursar, and financial assistance data. There were four main issues to contend with during the application design: security, performance, usability, and host support.

Web applications have the image of being insecure. Web designers must be all the more diligent to achieve acceptance for their work. It is important to employ a Web server offering data encryption. Many of our clients are located in public sites on the campus. Therefore, we don’t cache personal information on the client, and we time out an authenticated session to limit someone else from coming along and assuming the identity at an unattended session. We also don’t include the student’s name or student identification number on a form containing personal information.

Our application provides students with access to potentially high-demand information such as grades and financial assistance. The server and network must be able to accommodate over 90,000 students inquiring about their grades. We tried to reduce graphical complexity to increase network speed.

We conducted usability sessions with students to determine if a unified look and feel was an aid to navigation within the application. We interconnect not only computer jargon but jargon from registrar, bursar, and financial assistance offices in one application and need to present this in terms students understand.

Servers supporting Web applications tend to lack a tradition of operational support. We will continue to find the need to develop standards for supporting Web applications.

Web applications offer a viable solution for contacting new audiences that were previously unreachable. In order for Web applications to be successful, it is essential that developers address the main issues of security, performance, usability and host support.

Gary Riggen
Manager of Development Technology Services
griggen@indiana.edu

Since August 1993, students at the University of Delaware have used Internet tools to access personal student information. The Gopher client enabled widespread availability to administrative data in 1993. In 1994, Mosaic provided cross-platform access using the protocols of the Web. Netscape’s browser and Secure Socket Layer security protocol were adopted in 1995 to provide secure gateway to student information.

Students use Web browsers from home, dorms, labs, classrooms, or kiosks to print grade reports and class schedules, drop and add classes, change address information, access financial records, and more (see http://www.mis.udel.edu/admin.html). Care was taken to ensure adequate security while opening closed, proprietary legacy systems for direct student use.
Because Delaware was an early adopter of the Web for administrative use, Web gateways to administrative systems were “home built.” With OS, DBMS, and application vendors providing Web gateways for nearly every environment, the “home built” approach is not necessary today. Eventually every data source will have an integral Web gateway, while every desktop will incorporate a Web browser. The job of Information Technology will no longer be to establish the infrastructure, rather IT will focus on the “packaging” of information for consumption on the Web.

The most valuable lesson learned at Delaware has been the need to design Webs that are customer-oriented and process-driven as opposed to the provider-oriented, task-list Webs that are most common on our campuses today.

Carl Jacobson
Director, Management Information Services
carlj@udel.edu

In 1995 the University of Maryland, Baltimore County began designing electronic delivery of student services. Since no commercial Web server was available for our HP Spectrum, we implemented a multi-tiered approach that was more flexible and secure to provide via the Web: class schedules; course class lists; registration eligibility, appointments, and authorization; seat availability; faculty registration authorization; student data; grades; transcripts; billing inquiry; class elections; and address updating.

Clients connect over SSL to the UNIX Netscape server, which authenticates them against our Kerberos server and maintains a set of open TCP sockets to our HP. Services on the HP are implemented by COBOL functions called from the process listening on the socket. Results are then passed back to the UNIX server, which inserts HTML code and presents them to the client.

Benefits include: security (we firewall all but the UNIX server from connecting to the HP), better performance on the HP (we don’t have to fork processes when requests arrive), and code portability (we use the same COBOL functions with our voice response unit).

Challenges include: socket processing between UNIX and HP, integration with telephone registration system, security, lack of staff, scheduling time on the HP, user training, and time.

Jack Suess
Associate Director
jack@umbc.edu
Joe Kirby
Assistant Director
kirby@umbc.edu
University Computing Services
University of Maryland, Baltimore County

York Technical College, in Rock Hill, South Carolina, is currently offering distance learning opportunities to our students via two-way interactive video and videotaped telecourses. We are planning for online course delivery in the near future. Current student services available via the Internet include online admissions applications and data retrieval for student loans, with plans for expansion of Web-based applications in several areas.

The College faces a number of issues in planning these systems: (1) additional resources for hardware and software upgrades, (2) system modifications for online activities, (3) limitations due to electronic services available at other colleges, (4) security to assure student privacy, and (5) technical skills and training needed for staff to create and use Web-based activities.

Louise C. Rhyne
Dean of Learning Resources
rhyne@a1.york.tec.sc.us

Selected responses to the Fall 1997 Readers Respond question will be printed in the next issue of CAUSE/EFFECT, space permitting. All replies will be included in the online edition available on the CAUSE Web server.

Fall 1997 Readers Respond Question

How is your institution addressing the issues related to “universal access” (as framed in the Graves article, pages 48-52), i.e., providing all faculty and students convenient and affordable access to your campus network?

Please send your response, along with your name, title, e-mail address, and phone and fax numbers by electronic mail to Elizabeth Harris, CAUSE/EFFECT Managing Editor, at eharris@cause.org.